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A Reconnaissance Survey of the Table River: 1995 Status Report

A. R. Langston
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The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave. 3rd Floor, Prince George B.C. V2L 3H9

Website: *www.bchydro.bc.ca/environment/initiatives/pwcp/*

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Author(s): Arne Langston[1]
Address(es): [1] Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave., 3rd Floor Prince George, B.C. V2L 3H9

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ABSTRACT

This report summarises the results of the 1995 Table River reconnaissance survey field activities. This report also summarises detailed data and results contained in two other reports currently in preparation: Fish Presence and Abundance Surveys of the Table River, 1995; and, Biophysical Habitat Surveys of the Table River, 1995. The reconnaissance survey of the Table River was conducted to identify current limitations to the fish populations, and habitat alterations/damage resultant from logging activities. An emphasis was placed on the study of the Table River Arctic grayling *(Thymallus arcticus)* population. Detailed habitat surveys were conducted on 27 sites (8.3 km) along the mainstem and tributaries. Aerial video surveys were conducted on the entire mainstem and 6 tributary streams (112.2 km). Industrial activity, primarily logging impacts to fish resource values were noted, and in some cases specific rehabilitation prescriptions identified. Electrofishing surveys were conducted at 28 sites (36,900 m^2) along the mainstem and tributaries. Underwater fish counts were conducted on the lower 36 km of the Table River mainstem.

ACKNOWLEDGEMENTS

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Field work was conducted by a team of British Columbia Conservation Foundation employees and Peace/Williston Fish and Wildlife Compensation Program staff. The field crew included Brian Blackman, Joe deLaronde, Josh Foerderer, Mark Hunter, Stephen Kristoffy, Arne Langston, Tracey Martin, and Randy Zemlak.

Maximum daily and instantaneous discharge estimates for the Table River, and confirmation of the watershed area were provided by Water Management Branch (BC Environment) staff Glen Davidson and Adam Wei.

The Tables (B4, B5, and B6) used to report and generate fish population estimates for the under water fish census were developed by Wendell Koning (BC Environment, Research Branch).

Critical review of the draft report was provided by Nick Baccante, Brian Blackman, Don Cadden, Bob Westcott, and Randy Zemlak.

A contribution from British Columbia Rail toward this project in the form of reduced accommodation charges at their Tacheeda Camp for project field personnel is greatly appreciated. In addition, I would like to personally thank all the BCR staff at Tacheeda Camp, and Charlene Danielson, for their assistance and information freely given toward this project.

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INTRODUCTION

A Reconnaissance Survey of the Table River was conducted in 1995. The main objectives were:

1. to gather life history information of fish species encountered, and their habitat requirements;

2. to identify current limitations to the fish populations, and habitat alterations/damage resultant from activities within the watershed (logging, road construction, railway construction); and

3. to prescribe management, mitigative, compensatory, and enhancement plans to restore the productive capacity of the Table River fish resource.

An important aspect of this survey will specifically identify the measures required to protect and enhance the Arctic grayling *(Thymallus arcticus)* population of the Table River. Arctic grayling populations within the Williston Reservoir watershed, which includes the Table River, are considered endangered (Figure 1). In 1995, the Ministry of Environment, Lands and Parks initiated protective measures by instituting a catch and release, regulation for Arctic grayling within the Williston Reservoir watershed. Arctic grayling are currently "Red Listed" (QS1) indicating that within the Williston Reservoir watershed, the species is critically imperilled because of extreme rarity or some factors making it vulnerable to extirpation or extinction (B.C. Conservation Data Centre 1995). For this reason Arctic grayling will be examined in detail in regards to the three main objectives of this study as listed above.

Life history information of Arctic grayling in Alaska has been well documented by Armstrong's review of Arctic grayling studies in Alaska (1986). Life history information of Arctic grayling populations within the Williston watershed is incomplete. A 1993 review of management and enhancement options by Northcote, and research projects by the Peace/Williston Fish & Wildlife Compensation Program (Langston and Zemlak 1995) have attempted to "fill in" some of the informational gaps. Opportunistic, small scale projects undertaken in recent years by the Peace/Williston Fish and Wildlife Compensation Program have provided limited Williston watershed Arctic grayling life history information. These studies have essentially identified the proverbial "tip of the iceberg", but have not been able to provide an adequate overall understanding of local Arctic grayling life history due to the limited size and scope of these past studies.

The Table River also supports a population of bull trout *(Salvelinus confluentus)*. This species is identified by the B.C. Conservation Data Centre as "blue listed" (S3) indicating that the species is rare or uncommon, and may be susceptible to large-scale disturbances. Life history information of bull trout (particularly juvenile stages) gathered during this study may be useful for future enhancement, and management applications for the Table River population. In addition, the life history information may be useful for bull trout management, protection, and enhancement in other rivers within the Williston Reservoir watershed.

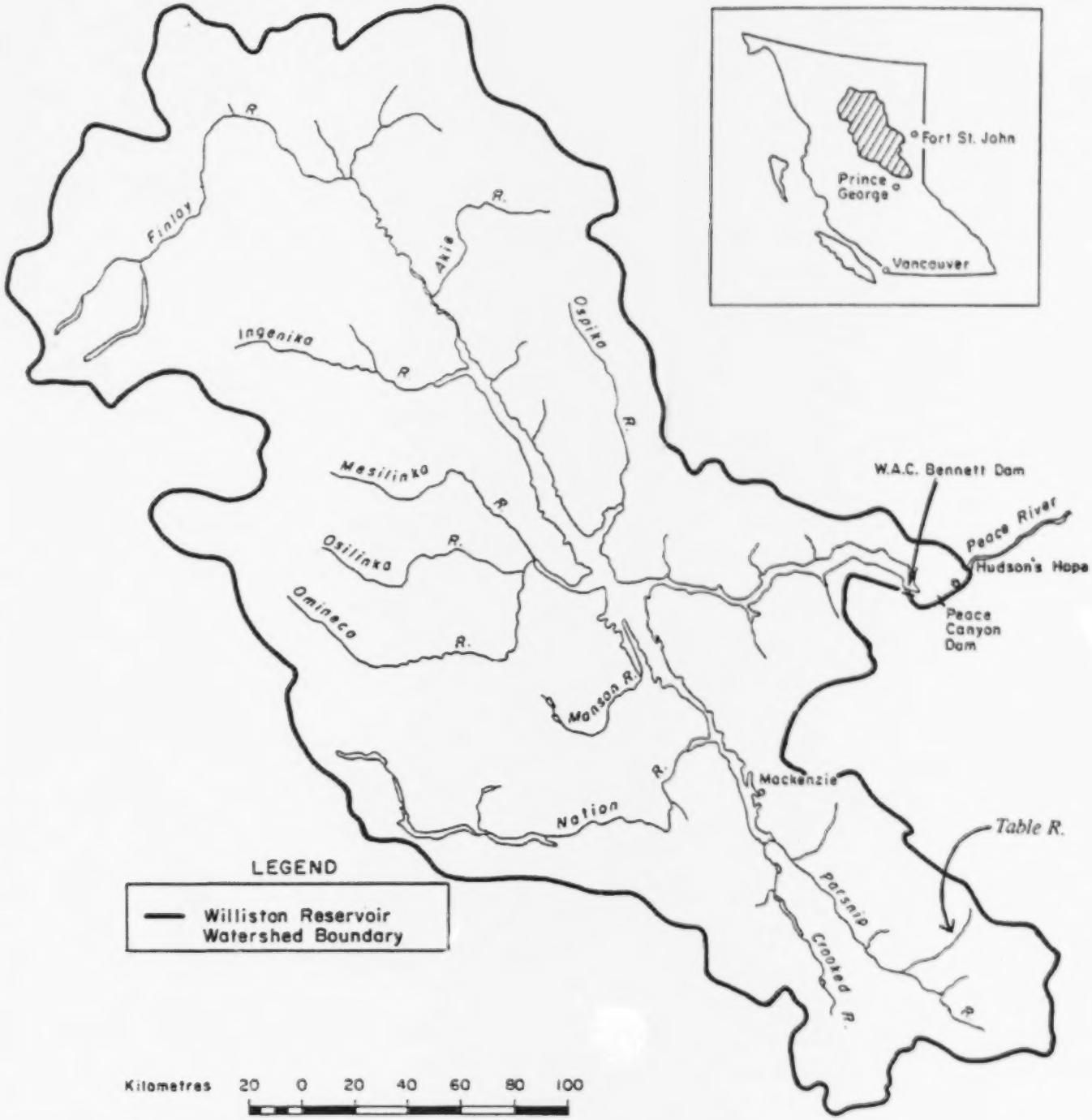

Figure 1. Location of the Williston Reservoir Watershed.

The Table River Reconnaissance Survey is the most detailed and complete survey of any system within the Williston Reservoir watershed to date. The knowledge acquired from this survey will be transferable and beneficial to many streams within the Williston watershed. The intensive research component of this survey is anticipated to require a minimum of four years, 1995 to 1998. The majority of the research should be complete by 1998, however a few studies to fill in informational gaps and confirm earlier field work, in preparation for restorative/enhancement projects, are anticipated in 1999. Emphasis will then be directed toward the implementation and evaluation of the effectiveness of restorative, enhancement, and management techniques.

This work is a co-operative research project co-funded by the Peace/Williston Fish and Wildlife Compensation Program and the Watershed Restoration Program (an initiative under the provincial Forest Renewal Plan). One of the goals of the Watershed Restoration Program (WRP) is to restore, protect, and maintain fisheries, aquatic, and forest resources that have been adversely impacted by forest-harvesting practises and that would require several decades to recover naturally. The goals of the Peace/Williston Fish and Wildlife Compensation Program are outlined in the Williston Lake Fisheries Compensation Program Management Plan (Blackman et. al. 1990). The Management Plan is quite dated. To remain consistent with BC Environment goals, objectives and policies, some of the points identified in the Management Plan are no longer applicable. A revised management plan is anticipated from the Peace/Williston Fish and Wildlife Compensation Program by 1999.

This status report summarises the 1995 field activities and results. A companion report, entitled "Fish species presence and abundance of the Table River, 1995, provides detailed results of all fish surveys.

The size and scope of the Table River study will increase in 1996. In co-operation with the Watershed Restoration Program, the Peace/Williston Fish and Wildlife Compensation Program will initiate an Arctic grayling radio tracking study in 1996 to identify key spawning and overwintering habitat. A pilot project designed to enhance fish resources and improve timber production in a logged valley bottom has been proposed for 1996. In addition the Compensation Program will initiate an Arctic grayling genetics study.

A series of annual status reports will be generated summarising each years activities. A final Table River Reconnaissance Survey report will be produced following the completion of field activities (anticipated 1998). Evaluation reports will be generated regarding the effectiveness of techniques employed to restore the Table River fish resource. Reports related to specific topics of study (grayling life history, grayling genetic diversity, enhancement techniques, specific stream restoration projects, etc.) are anticipated. Data collected at Table River will be compared to existing data.

BACKGROUND

Study Area

The Table River is located in the Hart Range Ecosection approximately 100 km north of Prince George, and situated in British Columbia's central interior (Figures 1 and 2). The watershed has an east to west aspect with the headwaters located in the Misinchinka Ranges of the Rocky Mountains. The river is 56 km in length, and drains a watershed of 50,600 ha. (506 km^2). The Table River is tributary to the Parsnip River. The confluence of these two rivers is situated 75 km upstream from the southern end of Williston Reservoir.

The Table River watershed is situated within the Sub-Boreal Spruce biogeoclimatic zone and the SBSwk2 biogeoclimatic unit (MacKinnon et. al. 1990). An SBSwk2 unit typically receives 550 to 1,915 mm of precipitation annually. The mean annual run-off (that amount of a watersheds annual precipitation which enters the stream) was estimated by Miles (1981) to be 800 mm. Mean annual air temperature is typically 1.0° C (Reynolds 1989).

The surficial substrate of the Table River study area is composed of colluvial materials found in the valley walls and lacustrine materials in the valley floor (Anonymous 1984). The upper one third (18 km) of the Table River flows through a narrow valley with steep mountain walls. The stream bed is comprised primarily of gravel and cobble with occasional bedrock outcroppings in the upper (high elevation) headwater area. The lower two thirds (36 km) meanders through a one to two kilometre wide valley flat. Near zero gradients with long glide stretches are common in the lower section, subsequently velocities are reduced and areas of sediment deposition are frequent.

No continuous discharge monitoring stations have been set up on the Table River. An investigation of the regional hydrology of the Northeast coal study area (Miles 1981) provides discharge estimates for a number of streams in the vicinity of Tumbler Ridge (60 km northeast of Table River). Miles (1981) generated a discharge estimate curve by employing a combination of "Creager's methodology" and gauging stations at "nearby" streams like the Pine, Murray, and Sukunka rivers. By comparing with the gauging stations, the Table River minimum discharge rate would be approximately 0.7 to 1.8 m^3/sec., and the mean discharge rate would be approximately 12.9 m3sec. These discharge estimates may be low as a discharge of 9.3 m^3/sec was observed (August 11, 1995) during what appeared to be low summer base flow conditions. The discharge estimate curve for maximum daily discharge was not applicable as the curve was generated with data from watersheds with basin areas greater than 2,072 km^2. The Water Management Branch of the Ministry of Environment, Lands and Parks estimated maximum discharge flows for the Table River based on data from the Parsnip, and Sukunka rivers. Table River discharge estimates are presented in Table 1.

Table 1. Estimated maximum discharge rates for the Table River.

Recurrence interval	Maximum Daily (m^3/sec)	Maximum Instantaneous Daily (m^3/sec)
1 year	94.6	107.2
50 year	155.1	175.7
100 year	168.4	190.3

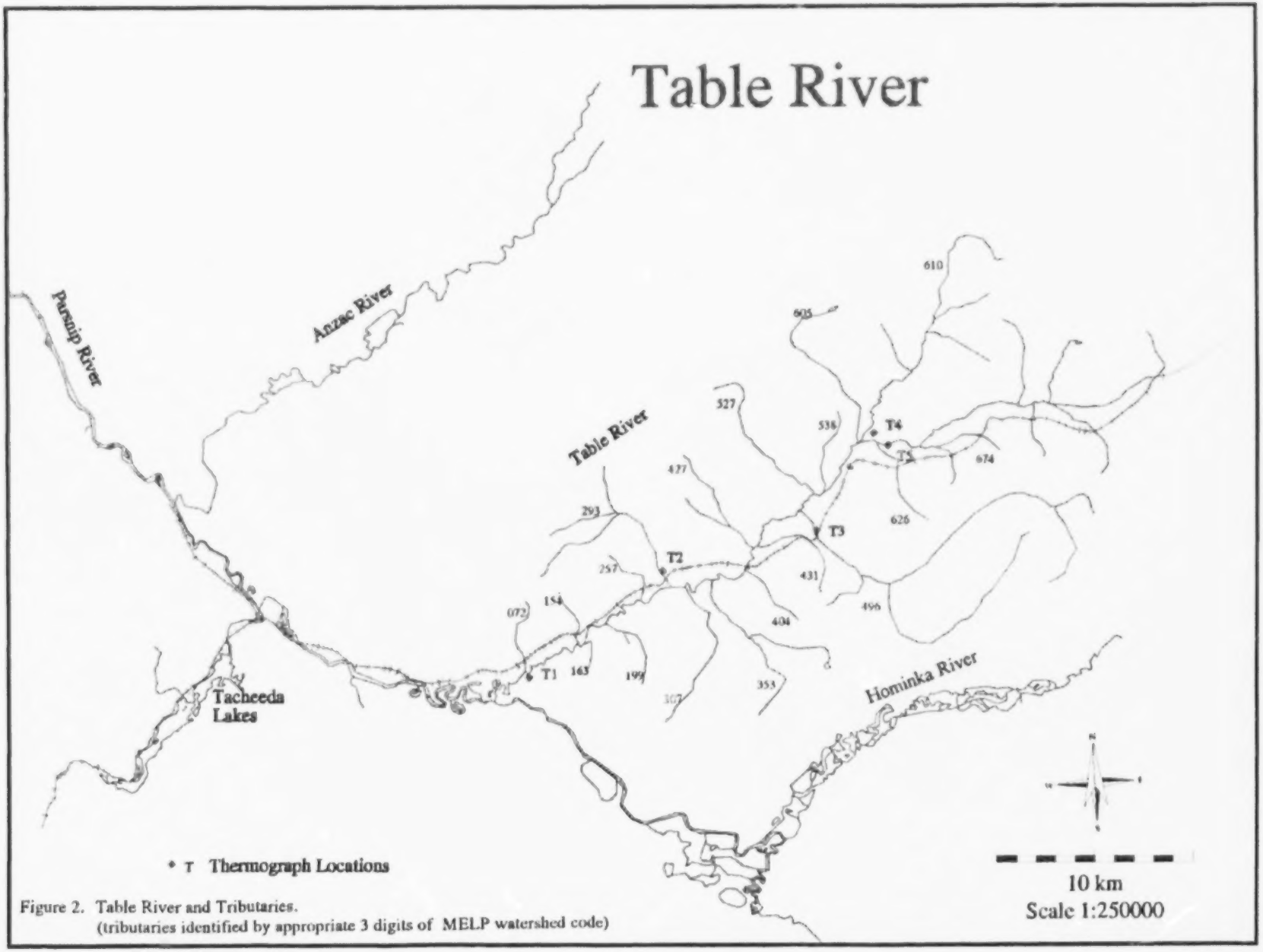

Figure 2. Table River and Tributaries.
(tributaries identified by appropriate 3 digits of MELP watershed code)

Logging History

Logging activity has been present in the watershed for approximately 30 years. Present activities are primarily silvicultural in nature with limited or no harvesting occurring since 1990. Due to the steep sides of the valley in the upper reaches, logging has been restricted to the lower two thirds of the Table River's length. Approximately 8%, or 4,000 ha., of the watershed has been harvested, and 40% of the stream length has logging activity up to or in the riparian zone. (Blackman 1995). The Pas Lumber Co. will be able to indicate the exact amount of area harvested once their new record keeping process is in place, anticipated by 1997 (Dave Jeweson, The Pas Lumber Co., pers. comm.).

Railroad History

Construction of the BCR electric railroad from Tacheeda Lakes to Tumbler Ridge was initiated in 1981. The line runs through the watershed, often parallel to and in close proximity to the Table River. The Railroad crosses (bridge) the Table River mainstem once, and crosses numerous tributaries. The railroad exits the watershed via a tunnel located near the headwaters, 54 km upstream from the mouth of the Table River. A road following the railroad was also constructed to the tunnel to facilitate railroad/tunnel maintenance.

Previous Habitat Studies

Between 1976 and 1978 the Resource Analysis Branch of the Ministry of Environment carried out an aquatic resource inventory of the entire area to be impacted by the development of the Northeast Coal Block. A preliminary environmental report (Environment and Land Use Sub-committee on Northeast Coal Development, 1978) was prepared, however, at that time the Table River was not considered as a site for development. As a result, the report provides very limited information regarding the fish habitat of the Table River. A later report (Harding 1979) provided similarly few details, but did identify the Table River as "an exceptional fish stream" being one of the most productive streams in the area immediately west of the Hart Ranges. No detailed field data was collected for either of these reports, as a result they provided only generalised descriptions of the Table River.

A detailed assessment of the aquatic resources within the Table River watershed was initiated in 1977 by the Resource Analysis Branch of the BC Ministry of Environment, but no report was generated by them. Acres Consulting (Anonymous 1984) provided a summarised version of the data collected in their 1984 report for the B.C. Railway. The data gathered in 1977 is available on Department of Fisheries and Oceans, and Ministry of Environment "stream survey forms", and Aquatic Biophysical maps (1 : 50,000 scale), on file with the Ministry of Environment, Lands and Parks (MELP). A past MELP employee (G. Oliver), who was actively involved with the 1977 study, was contacted and has provided further information as to methodologies followed. The data collected in 1977, where possible, will be compared to the data collected in 1995, and future years, to provide pre- and post-impact comparisons of fish habitat.

METHODS

Fish Habitat Assessment

The Table River survey has a number of inter-related objectives. As a result more fish habitat parameters than would normally be examined for a single purpose study needed to be collected, specifically:

1. Level Two Inventory was conducted as prescribed in the Watershed Restoration Program's "Fish Habitat Assessment (Interim Methods)", Technical Circular No. 8 (Anonymous 1994a) ,

2. Reconnaissance Level Stream Inventory following standards identified in the Fish Habitat Inventory and Information Program: Stream Survey Field Guide (Anonymous 1989), and the BC Environment, Department of Fisheries and Oceans Stream Inventory Manual (June 1, 1994 draft) (Anonymous 1994b).

3. aquatic biophysical parameters not collected in the above two surveys, but utilised by the Peace/Williston Fish and Wildlife Compensation Program to compare to the 1977 unpublished data collected by the Resource Analysis Branch of the Ministry of Environment (Chamberlin 1980); and

4. habitat preference of Arctic grayling, i.e. velocities, substrates, and cover.

Fish habitat parameters were recorded on two types of data collection forms. The first form was the Department of Fisheries and Oceans, and Ministry of Environment Stream Survey Form (Appendix A). The second form was designed by Program staff which would include all data required for a Level 2 Watershed Restoration Program (WRP) Inventory (Appendix A).

In preparation for this study the mainstem Table River was divided into one kilometre sections starting at the mouth (0 km) and continuing upstream to 55 km (Fig. 3). The precise location to of the kilometre points were determined by map (1 : 50,000 NTS, NAD 27 datum) and air photo interpolation, coupled with known locations of tributary mouths provided by BC Environment's Watershed Dictionary (based on NAD 27 datum and consistent with 1 : 50,000 NTS maps). The Starting at the 36 km point, and continuing downstream, a sign with the appropriate kilometre marker was erected on shore. This provided an additional location reference on the mainstem Table River. Tributaries to the Table River were referred to by the three digits of their watershed code (Figures 2 and 3) which immediately follow the digits designated for the Table River listed in the MELP Watershed Dictionary.

Ground surveys were conducted at numerous locations to provide accurate and detailed measurements of habitat parameters (reach breaks, cover, etc.) as identified by the two data collection forms listed above. Data was collected following the methodologies outlined in:

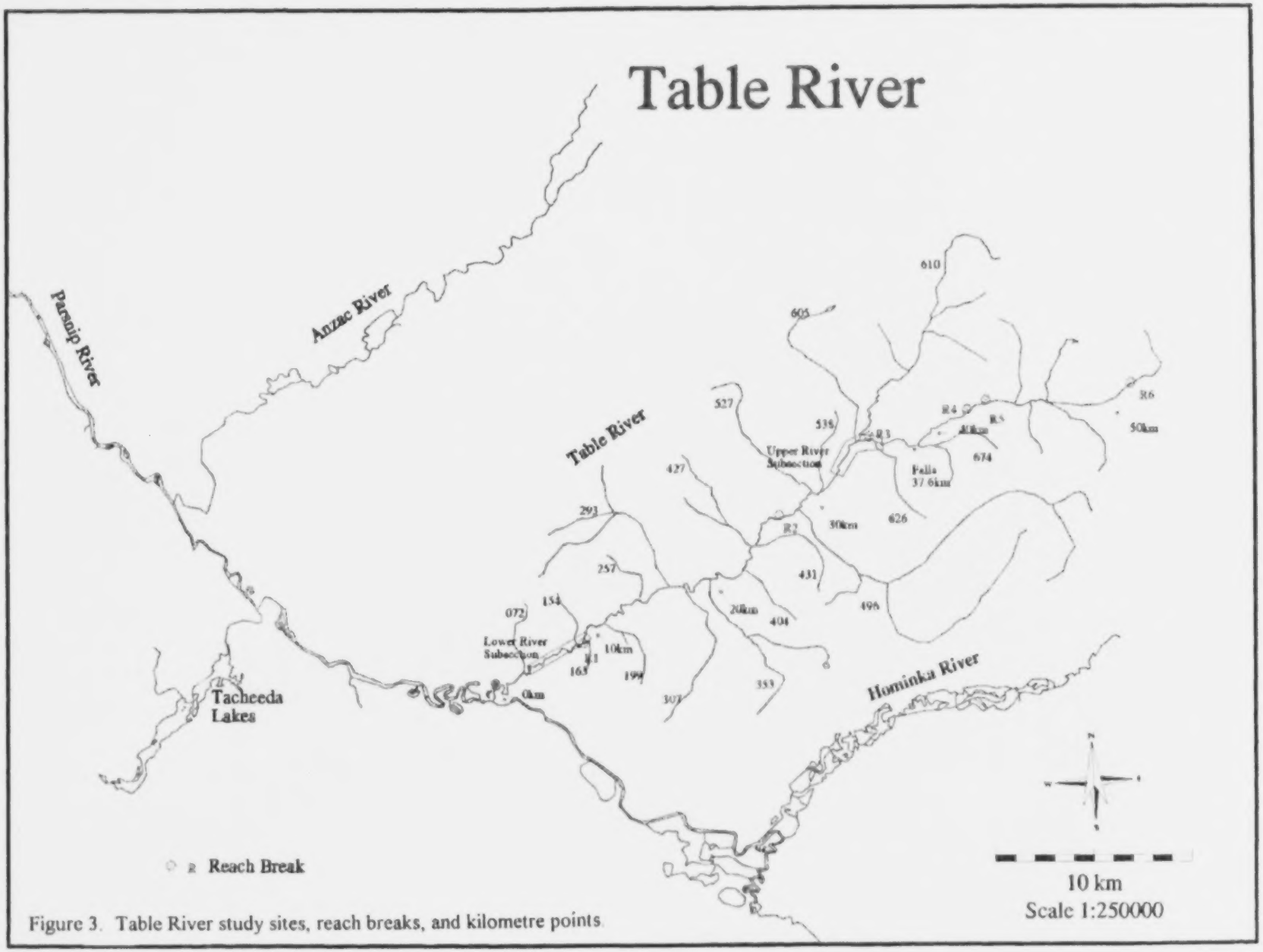

Figure 3. Table River study sites, reach breaks, and kilometre points.

1. Fish Habitat Assessment (Interim Methods). Watershed Restoration Program's Technical Circular No. 8,

2. Fish Habitat Inventory and Information Program: Stream survey field guide. (Dept. of Fisheries and Oceans, B.C. Environment, 1989); and

3. Stream inventory manual (June 1, 1994 Draft). B.C. Ministry of Environment, Lands and Parks, and Department of Fisheries and Oceans.

The ground surveys were conducted at both tributary, and mainstem locations. The tributaries and mainstem were not segregated into reaches prior to these ground surveys, therefore decisions as to stream locations to survey were based on map and air photo interpolation. Ease of access was also a consideration, though not essential, in selection of survey sites. At each site a continuous length of stream was surveyed which could be considered representative or typical of a much longer length of stream (stream reach).

An aerial video survey was conducted for 54 km of the mainstem Table River. It was not economically feasible to video survey all (50) tributaries of the Table River. Tributaries which were video surveyed included those with known fisheries values from previous studies, streams with obvious logging impacts, and streams with limited access

Fish Sampling and Abundance Surveys

Juveniles

To determine juvenile fish species presence in the Table River watershed, electrofishing was conducted in tributaries and the mainstem. Two methods of electrofishing were used to identify: 1) fish population estimates (densities), and 2) species presence or absence. To estimate fish population size a removal method (minimum two pass) within a closed site (typically 440 m^2), was used. The estimates of fish populations were generated by the American Fisheries Society (AFS) program "Microfish 3.0". Presence or absence of fish species was determined by electrofishing much larger areas but without the use of stop nets.

All captured fish were sorted by species, enumerated, and sampled. Fish were anaesthetised with a solution of one Alka seltzer tablet dissolved in approximately 3 litres of fresh water. Fork lengths were measured to an accuracy of 1 mm. Weights were measured on a digital balance to an accuracy of 0.1 g. Scale samples were obtained from all captured Arctic grayling, and a representative sample of rainbow and bull trout. All fish mortalities were enumerated, recorded by species, and sampled in the same manner.

Adults

An underwater fish count was conducted from the 35.5 km point to the mouth (0 km), with the exception of km 29 - 24 which was not surveyed due to difficult access. Experienced swimmers equipped with dry suits, masks, and snorkels floated downstream, in pre-assigned lanes, and recorded all fish observed during a single pass survey for each one kilometre length of stream. The swimmer's lanes encompassed the mid-channel and near shore zone of the river. Mean wetted widths and visibility for each kilometre section were measured to provide values required to generate an expanded count. The expanded count compensates for the swimmers inability to "see" across the entire width of the channel when underwater. The "visibility" is the maximum underwater distance that a swimmer can positively identify a fish species and estimate its size.

The underwater survey results were also used to identify two representative subsection sites for population estimation (Fig. 3). The sites selected were, km 35.5 to km 32 (upper river site), and km 9.8 to km 5 (lower river site). The two sites were chosen as they represented the two general types of mainstem habitat encountered. The upper river site provided a representation of km 37.6 (falls) to km 26.7. The lower river site provided a representation of the Table River from km 26.7 to the mouth (Reaches 1 and 2).

Prior to swimming the two subsections, fish were marked. Angling techniques were used to capture fish in the upper and lower river sites. Artificial flies, lures (spinners and spoons), and various baits were utilised. Arctic grayling, rainbow and bull trout larger than 200 mm were tagged and released. Scale samples were taken from rainbow trout and Arctic grayling of all sizes, and bull trout less than 350 mm in length. Fin ray samples were obtained from bull trout greater than 350 mm in length.

Underwater fish counts of the two representative sub sections of the Table River were undertaken following methodologies outlined in Slaney and Martin (1987). Petersen mark-recapture population estimates were generated for Arctic grayling, rainbow and bull trout. Twenty percent of the population of each species was required to be Floy tagged as specified by Vincent (1971). A hooking mortality estimate of 4% was used based on Wydoski's 1977 fly-fishing hooking mortality study. Underwater counts were conducted twice for each sub section site to provide two replicate counts. If the swimmers combined visual range did not cover the entire stream width, an expansion factor was applied to compensate for fish which were not observed due to visual distance limitations. If the swimmers combined visual range did cover the entire stream width, then theoretically no fish should be missed and therefore counts were not subject to visual limitation expansion factors. However, all fish are not detected in each swim due to factors such as fish "hiding", and swimmer's attention distracted by other fish. For this reason a correction factor is calculated (as in Slaney and Martin 1987). The correction factor is calculated by dividing the population value that "should" be present, as obtained by the "mark-recapture" study, by the actual number of fish (expansion factor included) observed by the swimmers. The resulting product represents the correction factor which must be applied to the swimmers observed and expanded fish counts.

Arctic Grayling Habitat Preference

Underwater observations of Arctic grayling habitat use were undertaken. Observers, equipped with dry suits, masks and snorkels, floated downstream as innocuously as possible in order to observe Arctic grayling exhibiting normal behaviour in their natural habitat. When a grayling was located, habitat parameters of the exact location where the fish was stationed were recorded. These included characteristics such as location, substrate, depth, cover, and type of habitat. A Marsh-McBirney current meter was used to measure water velocities at three depths at the exact location where the fish was located, 10 cm from the bottom, the 60% point of the water column (i.e. if water 1 m deep, then velocity measured 40 cm from the bottom), and at the surface.

RESULTS AND DISCUSSION

Fish Habitat Assessment

Detailed habitat inventory information (ground surveys) has been collected for 5 sites (cumulative total of 2.0 km) along the mainstem of the Table River, and a total of 22 sites (5.7 km) from 15 tributary streams. A summary of the results of the fish habitat assessment surveys is presented in Table 2. A key for the headings in this table immediately follows Table 2. Detailed site information and analysis will be prepared for a future report entitled "A Summary Report of the Table River Surveys 1996 Status Report", and entered on 1:20,000 scale BC Geographic Systems (BCGS) maps.

Aerial surveys produced a video record of the entire Table River mainstem (56 km). A video record was also created for six tributary streams (tributaries 353, 496, 527, 605, 610, and 626) representing 56.2 km of habitat. This video documentation has enabled the sub

Table 2. STREAM SURVEY FORM SUMMARY TABLE RIVER

STREAM NAME	RE. No.	ST. No.	VID.	TOTAL LENGTH (m)	LENGTH SURVEYED (m)	DATE OF SURVEY (y/m/d)	AVG. W.W. (m)	AVG. CH. W. (m)	GRAD. (%)	SURFACE AREA (m^2)	AREA OF Pool (m^2)	Glide (m^2)	Riffle (m^2)	SUBSTRATE X D-90 (cm)	Fines (%)	Gravels (%)	Larges (%)	FLOW Method	RESULTS Discharge (m^3/s)
Tributary 072	1	1	N	4,378	~300	95/07/18	2.0	4.0	-	600	300	0	0	5	90	10	0	FM	0.278
Tributary 154	1	1	N	3,763	165	95/08/30	3.0	5.0	2.6	495	50	0	445	10	50	30	20	NFT	-
	2	1	"	"	203	"	3.0	5.0	1.9	619	25	0	594	15	10	50	40	"	-
	3	1	"	"	79	95/08/31	3.1	4.4	3.5	245	46	18	180	13.7	20	40	40	"	-
Tributary 163	-	1	N	?	100	95/08/29	1.0	1.5	6.8	100	10	0	90	9	10	80	10	NFT	-
Tributary199	-	1	N	5,720	160	95/08/29	4.7	5.9	1.2	758	79	16	663	6.7	10	80	10	NFT	-
Trubutary 257	-	1	N	?	400	95/08/30	6.0	-	0.0	2,400	2,400	0	0	2	80	20	0	NFT	-
	"	1	"	"	165	"	1.0	1.0	5.5	165	16	0	149	10	10	60	30	"	-
Tributary 293	1	1	N	10,192	589	95/07/10	7.7	14.8	0.8	4,523	365	1,294	2,118	24.3	10	30	60	FOM	2.098
	1	2	"	"	160	95/08/25	11.3	14.2	0.8	1,802	150	180	1,472	24.6	10	20	70	NFT	-
	2	1	"	"	50	"	7.8	11.4	1.0	388	0	38	350	39.5	10	30	60	FOM	2.415
Tributary 353	1	1	Y	10,162	252	95/09/13	7.0	12.1	0.6	1,762	202	724	836	14.6	30	40	30	NFT	-
Tributary 404	1	1	N	4,455	159	95/07/12	4.4	10.2	5.2	693	0	36	657	37	10	10	80	FOM	0.324
Tributary 427	1	1	N	5,909	405	95/07/05	4.2	5.1	1.0	1,689	179	0	1,511	10.8	20	30	50	FOM	0.702
Tributary 431	-	1	N	6,733	189	95/08/24	3.3	4.7	0.9	630	110	107	413	6.8	50	40	10	FM	0.169
Tributary 496	1	1	Y	24,245	729	95/07/08	12.9	18.6	0.7	9,231	965	1,018	7,248	51.5	10	20	70	FOM	3.795
	3	1	"	"	128	95/09/29	5.5	18.6	0.2	705	0	442	263	20.2	20	50	30	NFT	-
Tributary 527	1	1	Y	10,074	169	95/09/29	5.3	14.5	0.8	897	161	215	521	15.1	10	30	60	FOM	0.125
Tributary 605	1	1	Y	11,400	394	95/08/23	10.8	19.9	0.5	4,063	841	1,119	2,103	34.1	10	20	70	NFT	-
Tributary 610	1	1	Y	19,046	540	95/07/20	12.1	17.3	0.2	6,543	656	2,597	3,290	26.1	20	30	50	FOM	1.928
Table R. (16 km)	2	1	Y	56,566	881	95/09/14	26.5	43.0	0.0	23,361	3,861	10,718	8,782	15.6	10	40	50	NFT	-
Tributary 626	1	1	Y	5,655	229	95/07/11	6.8	8.6	1.2	1,552	192	168	1,192	10.8	10	60	30	NFT	-
	2	1	"	"	166	95/07/12	5.2	9.2	6.1	867	36	0	799	60	10	10	80	"	-
Table R. (~35 km)	4	1	Y	56,566	614	95/09/19	9.4	18.1	0.0	5,789	225	2,027	3,537	8.4	20	40	40	FM	2.108
Table R. (~38 km)	4	2	Y	56,566	429	95/09/27	13.2	21.3	0.2	5,654	342	1,657	3,655	13	10	40	50	FOM	1.168
Table R. (~51 km)	6	1	Y	56,566	87	95/09/29	5.8	12.2	0.7	502	145	162	195	7.5	20	60	20	FOM	0.38
Table R. (~54 km)	7	1	Y	56,566	30	95/08/15	5.0	6.3	3.5	150	8	0	142	60	15	15	70	FM	0.449

Table 2. KEY FOR THE STREAM SURVEY FORM SUMMARY TABLE RIVER

STREAM NAME	RE. No.	ST. No.	VID.	TOTAL LENGTH (m)	LENGTH SURVEYED (m)	DATE OF SURVEY (y/m/d)	AVG. W.W. (m)	AVG. CH. W. (m)	GRAD. (%)	SURFACE AREA (m^2)	AREA OF Pool (m^2)	Glide (m^2)	Riffle (m^2)	SUBSTRATE X D-90 (cm)	Fines (%)	Gravels (%)	Larges (%)	FLOW RESULTS Method	Discharge (m^3/s)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

1) "STREAM NAME" - Gazetted name or alias name of stream.

2) "RE. No." - Reach number location as separated by hydrological units.

3) "ST. No." - Site number location.

4) "VID." - Indicates whether the stream has been video taped from a helicopter - "Y" indicates yes and "N" indicates no.

5) "TOTAL LENGTH" - Indicated the total length of the stream expressed in metres. *This is not the length of an individual reach

6) "LENGTH SURVEYED" - The total length of stream, or reach, surveyed expressed in metres.

7) "DATE OF SURVEY" - The data at which the survey took place expressed in the year/month/day format.

8) "AVG. W.W." - The average wetted width of the stream in the surveyed section of the reach expressed in metres.

9) "AVG. CH. W." - The average channel width of the stream in the surveyed section of the reach expressed in metres.

10) "GRAD." - Indicates the stream gradient and is expressed as a percentage.

11) "SURFACE AREA" - The surface area of the entire surveyed section expressed in square metres.

12) "AREA OF, Pool" - Indicates the percentage of pool within the survey area.

13) "AREA OF, Glide" - Indicates the percentage of glide within the survey area.

14) "AREA OF, Riffle" - Indicates the percentage of riffle within the survey area.

15) "SUBSTRATE, X D-90" - Indicates the mean diameter of of the individual bed material, expressed in cm, which is larger than 90% of the remaining material.

16) "SUBSTRATE, Fines" - Indicates the percentage of bed material composed of fines (< 2 mm).

17) "SUBSTRATE, Gravels" - Indicates the percentage of bed material composed of gravels (2 - 64 mm).

18) "SUBSTRATE, Larges" - Indicates the percentage of bed material composed of larges (> 64 mm, excluding bedrock).

19) "FLOW RESULTS, Method" - Indicates the method used to determine the stream rate of flow.
FM - indicates a Marsh M^{c}BIRNEY Model 2000 Flow Meter was used.
FOM - indicates the floating object method was used.
NFT - indicates that no flow test was taken.

20) "FLOW RESULTS, Discharge" - Indicates the discharge of the stream expressed in cubic metres per second.

division of the mainstem Table River, and tributaries flown, into representative reaches. The Table River mainstem contains seven reaches. Reach breaks were also identified on nine of the tributaries surveyed. The location of the mainstem Table River reach breaks are identified on Figure 3. Exact locations of reach breaks (mainstem and tributaries), and descriptions of specific reaches are provided in further detail in "A Summary Report of the Table River Surveys 1996 Status Report" (Mathias et. al. 1998).

The Table River mainstem and tributaries contain areas of habitat concern, particularly slumping or failing banks, and beaver activity. A number of these sites are naturally occurring, however numerous sites have been identified where logging to stream edge has produced increased channel migration, failing banks and associated increases in turbidity and siltation. Identification of these sites is on going and site specific inspections will be undertaken in 1996 to properly assess the best restorative techniques to employ.

The aerial and ground surveys provided data for addition to the BCGS maps. These maps will be available in the report Biophysical Habitat Surveys of the Table River (in prep.) Specific information added to the maps include:

1) locations of fish species presence;
2) fish production potential of specific sites and reaches;
3) areas of habitat concern, relating to naturally occurring or logging induced habitat degradation;
4) barriers or areas of difficult fish passage; and
5) habitat characteristics (reach breaks, substrate, channel morphology, etc.).

Naturally Occurring Fish Habitat Impacts

The Table River headwaters are located in the Rocky Mountains where substrate size is large, bedrock common, and fines less common. The lower two thirds of the river are lower gradient and were subject to glacial deposition of fine material (Anonymous 1984). Naturally occurring unstable clay/silt banks are common in the valley. An abundant annual rainfall, and snowfall are characteristic of this watershed. High water events with resultant increased turbidity from naturally occurring unstable mainstem and tributary banks is potentially a common occurrence. Deposition of sediment in the lower, slow moving sections, of the Table River would be at least partially attributable to these natural events. However, industrial activities within the watershed have likely increased the severity and occurrences of these events.

Activity Related Fish Habitat Impacts

During railroad and tunnel construction sediment levels and turbidity were extremely high. A 1980 Sigma Resource Consultants Ltd. report prepared for the B.C. Ministry of Industry and Small Business Development indicated that it was highly probable that erosion of readily erodable soils in the Table River valley during construction would create adverse impacts on the productive aquatic environment. Siltation and turbidity levels during construction were elevated to a point where mainstem aquatic production (fish, insects, algae)

was severely impacted for three to four years (Dave King, Habitat Biologist, Ministry of Environment, Lands and Parks, Prince George, B.C., pers. comm.). A 1984 Acres Consulting report for British Columbia Railway indicated that sediments occurring from railroad construction in 1981 - 1983 were of the same order of magnitude as the combination of naturally produced silt from bank erosion and logging of the catchment basin. The report also indicated that the river system was capable of "handling" the increased sediment load, flushing sediments to the Parsnip River. The assertions are contentious points as the Ministry of Environment (Northern Region) was not satisfied with the contents of the report (see file 75.700101 Ministry of Environment Regional Critique).

Although turbidity levels decreased after approximately three years, detrimental sediment/silt deposition in the mainstem Table River likely remained for many years. Increased fines deposition (due to industrial activities) impacts would have been most severe in the upper 21 km of the river as there were no naturally occurring large point sources (eroding glacial till stream banks) identified. The lower 35 km of the Table River is subject to some degree of naturally occurring silt deposition, therefore increased rates of deposition due to industrial activity may have less of an overall impact here than experienced in the headwaters. It is possible that remnants of construction siltation, and resultant impacts to fish, still persist in the low gradient sections of the lower river. No new sources of silt and sedimentation related to past railroad construction, or erosion of stream banks associated with the railroad, were observed. Mitigative techniques, including hydroseeding, and natural recovery appear to have stabilised most areas of erodible soils related to railroad and tunnel construction.

Logging activity within the watershed has impacted fish habitat. Clear cuts and associated access roads extending to the banks of the Table River and numerous tributary streams are common. Resultant access barriers, unstable banks, stream channel widening and migration, increased turbidity and siltation are all evident. Floodplain and stream bank logging may have increased channel migration and reduced sources of large woody debris (Blackman 1995).

An intensive harvest occurred in 1989/90 approximately 35 km upstream from the mouth of the Table River. A combined area in excess of 5 km^2 (three cut blocks) was harvested along the mainstem and three tributaries of the Table River. This area was harvested in response to a major natural blow-down event. The three large clearcuts have created habitat impacts, including increased sediment loading and resultant turbidity, and increased sediment deposition to downstream sections of the Table River mainstem.

Water Temperatures

Water temperatures recorded at the five recording sites (Fig. 1) are summarised in Table 3, and presented in Figure 4. The variation between the minimum and maximum daily temperatures for individual sites on the Table River was 1 - 2 °C. The mean daily water temperatures in the Table River (lower site) were 9.5 °C in June, peaking at 11.8 °C in July, dropping two degrees in August and September (partially due to high rainfall) and dropping sharply in the first two weeks of October to 5.5 °C.

The water temperatures measured at Tributary 496 are not continuous. The stream level had dropped to a point where the recorder was out of the water for September 16 to September 30. It is important to note that the September mean temperature was derived from only the first 15 days of that month. Had the last 16 days also been recorded and included in the calculation the mean for September would likely have been lower.

The mean water temperature from June 8 to October 15 of the upper section of the Table River was 8.0 °C, 1.7 °C cooler than the lower river (Table 3). This temperature difference likely explains the increasing number of rainbow trout as one progresses downstream. The increase in sucker densities would also be attributable to the warmer temperature; however, increased gradient and velocity in the upper section would also be a factor.

Table 3. Mean daily water temperatures by survey duration (June 8 - October 15) and month.

Location	June 8 - October 15	June	July	August	September	October
Upper Table River	8.0	7.6	9.7	8.3	7.8	5.2
Tributary 610	8.1	7.1	9.4	8.4	8.5	5.3
Tributary 496	8.3*	8.0	10.3	8.2	9.0*	4.3
Tributary 293	8.4	8.6	10.1	8.4	8.1	4.8
Lower Table River	9.7	9.5	11.8	9.7	9.6	5.5

*no temperature data is available for September 13 - 29.

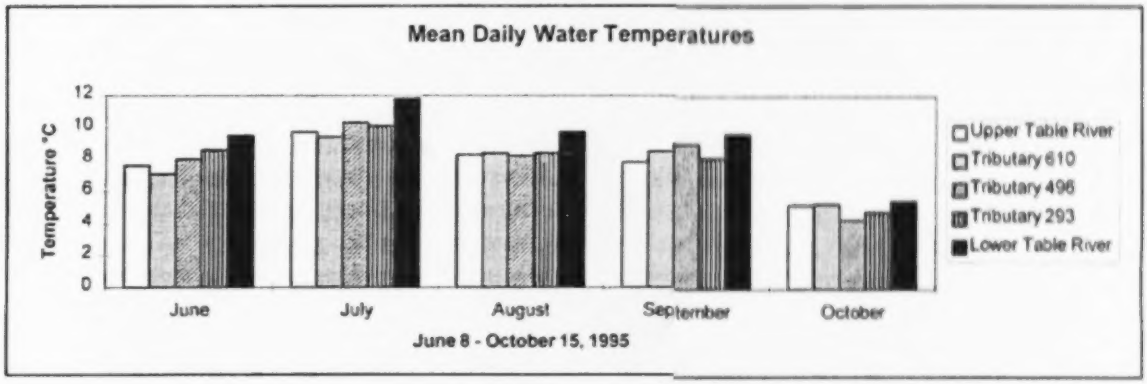

Figure 4. Comparison of mean daily temperatures by month for the 5 recording locations.

The water temperatures at the lower Table River site were generally 1.5 degrees higher than the other four sites. The temperatures from the other four sites were extremely similar, rarely varying by more than one degree. Figure 5 graphically presents the mean daily water temperatures for the 5 locations monitored. The changes in water temperatures that occurred over time at each site were identical with peaks and lows occurring at the same time.

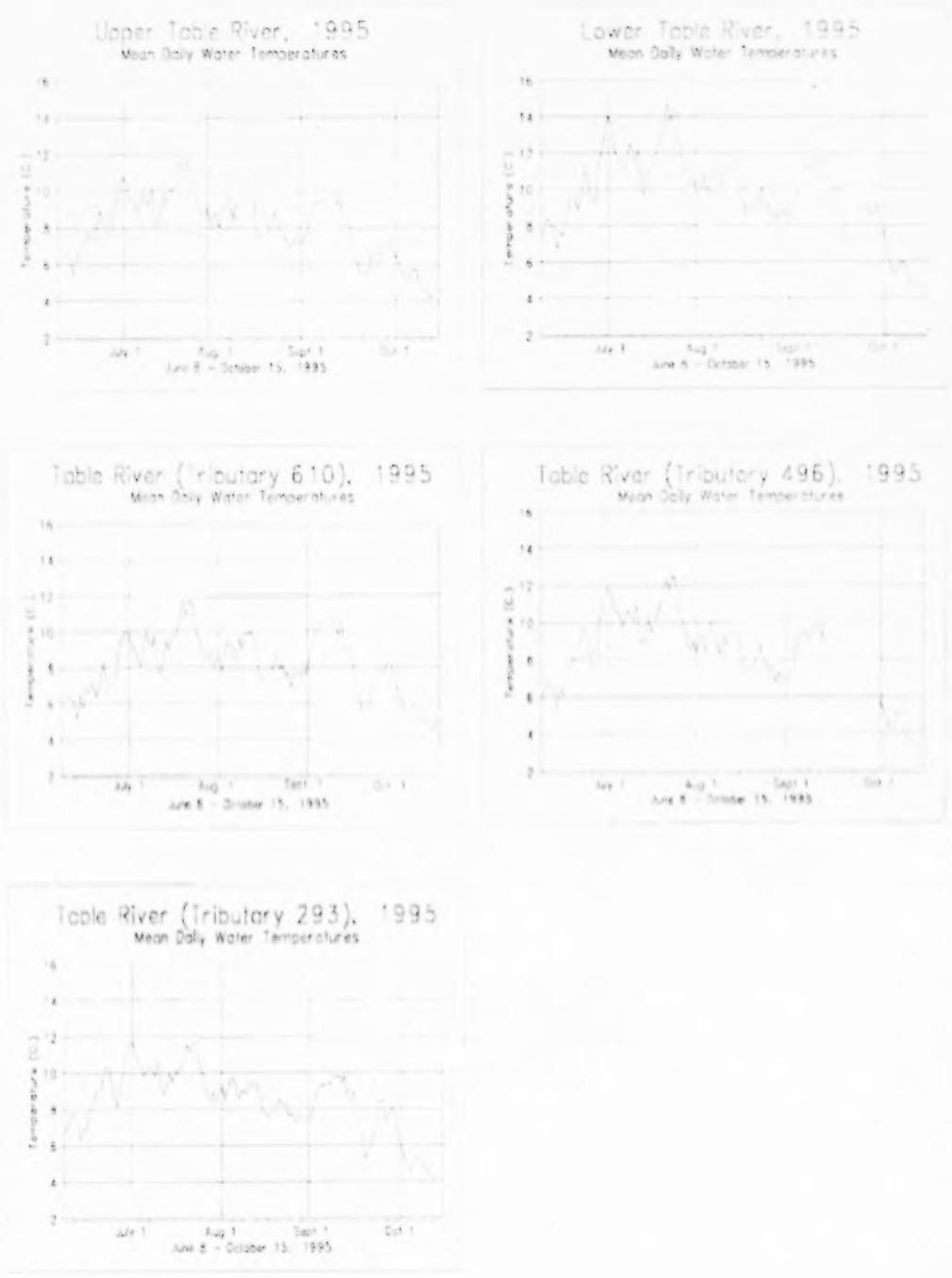
Upper Table River, 1995
Mean Daily Water Temperatures
Lower Table River, 1995
Mean Daily Water Temperatures
Table River (Tributary 610), 1995
Mean Daily Water Temperatures
Table River (Tributary 496), 1995
Mean Daily Water Temperatures
Table River (Tributary 293), 1995
Mean Daily Water Temperatures

Figure 5. Water temperatures measured from June 8 to October 15, at the five thermograph locations (T1 - T5, see Fig. 2).

Fish Species of Table River

Fish observed in the Table River watershed included; Arctic grayling, bull trout, burbot *(Lota lota),* dace *(Rhinichthys sp),* mountain whitefish *(Prosopium williamsoni),* Northern squawfish *(Ptychocheilus oregonensis),* rainbow trout, sculpins *(Cottus* sp.), and suckers *(Catostomus* sp.). Sculpins, suckers, and dace were not keyed out to species during the 1995 field studies. Previous studies by the Resource Analysis Branch of the Ministry of Environment identified sculpins captured in the Table River as slimy sculpins *(Cottus cognatus).* The 1980 Sigma Resources Consultants Ltd. report indicate the presence of prickly sculpins *(Cottus asper),* longnose suckers *(Catostomus catostomus),* coarse (large scale) suckers *(Catostomus macrocheilus),* and white suckers *(Catostomus commersoni)* in the Table River. Dace have not previously been observed in the Table River, however, the 1980 Sigma Resources Consultants Ltd. report identified the presence of longnose dace *(Rhinichthys cataractae)* in the Parsnip River.

A barrier (2 m vertical waterfall) to most fish species is located 37.6 km upstream from the mouth of the Table River. Only bull trout and sculpins were captured above the waterfall. A further 5.1 km upstream (km 42.7) a series of cascades, including a one metre waterfall, present another area of difficult passage. Bull trout were captured upstream of 42.7 km indicating successful migration past these cascades, however, sculpins were not. Sculpins could not have migrated unaided past the first 2 m waterfall at km 37.6. It is unknown how the sculpins initially accessed and colonised the area upstream of the first waterfall. The population of sculpins upstream of the waterfall at km 37.6 are isolated within the 5.1 km between the two areas of difficult passage.

Downstream of the falls at km 37.6 bull trout, mountain whitefish, rainbow trout, and sculpins were distributed throughout the mainstem and the accessible reaches of tributaries. Arctic grayling were only encountered in the mainstem of the Table River. Suckers were generally located only in the lower 20 km of the mainstem and associated tributaries. Burbot, dace, and northern squawfish were observed too infrequently to define their distribution. Detailed analysis of juvenile and adult fish sampled (i.e. age, length, weight, location captured) and population estimate results is presented in Fish Species Presence and Abundance of the Table River, 1995 (Zemlak and Langston 1998).

Fish Abundance

Juveniles (abundance determined by electrofishing studies)

Juvenile fish were found exclusively by electrofishing, with the exception of a few dace, sculpins, and suckers captured by gee trapping. Electrofishing was undertaken at 40 locations within the watershed. Sixteen sites were on the Table River mainstem, and 24 sites were situated on 15 of the Table River tributaries. The total surface area electrofished was 39,983 m^2. Surface area electrofished in the tributaries was 24,785 m^2, or 62% of total effort. Mainstem electrofishing covered 15,198 m^2, representing only 38% of the electrofishing effort. A summary of all electrofishing captured fish is presented in Table 4. All fish included in this table are juveniles with the exception of sculpins which have been included

here for ease of reporting. A detailed summary of sites surveyed and fish captured is presented in Table B2 (Appendix B). Detailed analysis of this data, including size at age analysis, and population estimates/densities is available in Fish Species Presence and Abundance of the Table River (Zemlak and Langston 1998).

Table 4. Fish captured by electrofishing.

Species	Captured in Mainstem	Captured in Tributaries	Total Fish Captured
Arctic grayling	13	0	13
bull trout	35	47	82
burbot	11	17	28
mountain whitefish	8	10	18
rainbow trout	16	119	135
sculpins	*224	447	*671
suckers	2	15	17

*represents sculpins enumerated, not all captured sculpins were enumerated.

A total of 964 individual fish were captured. Sculpins (671) were the most abundant fish species captured. Sixty seven percent of the enumerated sculpins were captured in tributaries. The number of sculpins enumerated in the mainstem, as presented in Table 4 is accurate. However, sculpins were captured in one mainstem site (km 34.1 to km 34.5) and not enumerated by the field crew. Instead the number of sculpins captured was recorded as "many" (see Table B2, Appendix B). Rainbow trout (135) were the next most abundant fish species and were captured primarily (88%) in the tributaries. Bull trout (82) were generally captured in equal numbers, with slightly more (57%) encountered in the tributaries. Burbot (28) and mountain whitefish (18) numbers were relatively low, and were generally captured in an even distribution between tributary and mainstem. Only two sucker juveniles were captured in the mainstem, the majority (15) were captured within tributaries. Twelve of these 15 suckers were captured in one electrofishing site at Tributary 431. Arctic grayling (13) were the least numerous among fish species captured by electrofishing. Arctic grayling were captured in only one section of the mainstem (km 26 to km 27), and none were captured in the tributaries.

Arctic grayling and bull trout juveniles may be present in much greater numbers in the mainstem than indicated by the results. The mainstem location where grayling juveniles were captured also supported juvenile 0+ bull trout (16). This electrofishing site was within habitat not expected (by the field crews) to support significant fish populations. The grayling were located in shallow water (10 cm or less) with primarily small cobble substrate, and little or no flow. The sites where grayling were found were usually associated with the downstream end of a long glide or pool, and just upstream of a riffle. Sixteen young of the year bull trout were also captured in this area. This location, in particular one 60 m^2 site within it, contained the highest concentrations of age 0+ bull trout or age 0+ grayling encountered in the Table River watershed). No examination of similar locations for fish presence was undertaken as the field activities ended shortly after discovery of this site.

The results of the electrofishing data as presented here, and in greater detail in Fish Species Presence and Abundance of the Table River, 1995 (Zemlak and Langston 1998),

suggest that the tributaries of the Table River afford the habitat most important for rainbow trout juveniles (age 0+ and 1+) and Sculpins. In contrast, the mainstem shore margin areas of the Table River may be the most important rearing location for Arctic grayling young of the year (age 0+). This is not necessarily contrary to indications that tributaries are the primary rearing habitat for young of the year, and 1+ grayling as reported by Stuart and Chislet 1979, and Olmstead et. al. 1982, as the Table River is tributary to the Parsnip River. The key must be the habitat characteristics of the tributaries, likely the discharge or size of the stream.

The Table River tributaries could be smaller than the preferred spawning habitat of Arctic grayling adults, thereby significantly reducing, if not eliminating, the possibility of young of the year grayling presence. However, this is unlikely as numerous sources (Armstrong 1986; Fernet 1986, 1987; Northcote 1993) do not report discharge when referring to spawning habitat requirements. Instead, preferred spawning habitat is indicated by depth and velocity. The spawning habitat preferences presented by these researchers indicate suitable habitat was available for spawning in the tributaries of the Table River.

The tributaries may be important for Arctic grayling spawning and egg incubation. As indicated previously, the reported spawning habitat requirements were present. However; the Arctic grayling fry may have migrated out, or have been "swept" out, of the tributaries and into the mainstem prior to the electrofishing surveys commencement in August.

The nearest Water Survey Canada discharge data collection site is on the Parsnip River approximately 60 km downstream from the mouth of the Table River. The preliminary results for April through October 1995 indicate flows of the Parsnip River were similar to the 23 year mean from 1968 to 1990 (Anonymous 1991). The variability and periods of high flows observed at the Table River in 1995 are probably the norm for this system. This may explain the absence of grayling juveniles in the tributaries as noted previously.

Identification of spawning locations is necessary to determine the importance of the Table River tributaries in the life cycle of Arctic grayling. A radio tracking study of adult grayling planned for 1996 and 1997 will fill this information gap.

The electrofishing results also identified a number of tributaries (072, 199 and 431) where barriers to upstream fish migration, primarily beaver dams, had prevented access to suitable fish habitat. Beaver activity increased in tributaries like 431 (Fig. 2) after logging activities returned the forest stand around the stream to an early successional stage. This early successional stage afforded preferred habitat for beaver as food sources such as willows replaced the mature spruce stands.

An enhancement project (scheduled for 1996) is proposed for tributary 431 which will remove beaver dam barriers, thereby allowing fish access to useable habitat. After logging occurred in the cutblock along tributary 431, beaver activity raised the water table of the area. With the water table close to the surface, reforestation through the planting of seedlings would take a longer period of time to result in a mature forest. The proposed enhancement project will remove beaver dams, prevent further dam construction through management of plant species in the riparian zone, and excavate drainage channels. The results should ensure fish

access to suitable, previously utilised habitat, and allow for a faster establishment of a mature forest by lowering the water table. Proposals for enhancing other tributaries in a similar fashion will follow pending the success of this pilot project.

Adults (abundance determined by underwater fish counts)

1. Whole river underwater fish count

Single pass two person underwater surveys were conducted on July 6 and 7, from km 35.5 to km 29, July 9 from km 24 to km 17, and July 18 and 19 from km 17 to the mouth of the Table River (0 km). A five kilometre section, from km 29 to 24, was not surveyed due to difficult access.

The actual numbers of fish observed, and estimated number of fish present (expansion factor applied) are indicated by kilometre section in Table B3 (Appendix B), and depicted graphically in Figure 6. No correction factor has been applied to these values. The expanded values for kilometre 36 have been doubled as only 500 m of this section was surveyed. The greatest concentrations of fish occurred in the km 36 to km 35 section.

At the time of survey, Arctic grayling are more abundant in the upper river, while sucker numbers were higher in the lower sections of the river. This occurrence is likely associated with spawning and summer rearing. Bull trout were observed to have a relatively uniform distribution with low concentrations along the entire river length. Rainbow trout numbers, while fairly uniform along the length of the river, increase slightly in the lower sections.

Spikes or locations of dramatic increase in fish numbers occur at the km 24, km 17, and km 7 sections ("All Fish Species", Figure 6). These sites are similar habitat types in that they contain deep pools or deep pools associated with a large debris jam. It has not been determined at this point if ideal adult summer rearing/feeding habitat such as these pools is a limiting factor to the overall fish population size of the Table River. These sites do have the capacity, due to their large size and depth of pools, to provide suitable overwintering habitat. If further investigations identify that this type of habitat is limiting population size the opportunity to enhance the fish populations through "debris catchers" and pool creation will be examined.

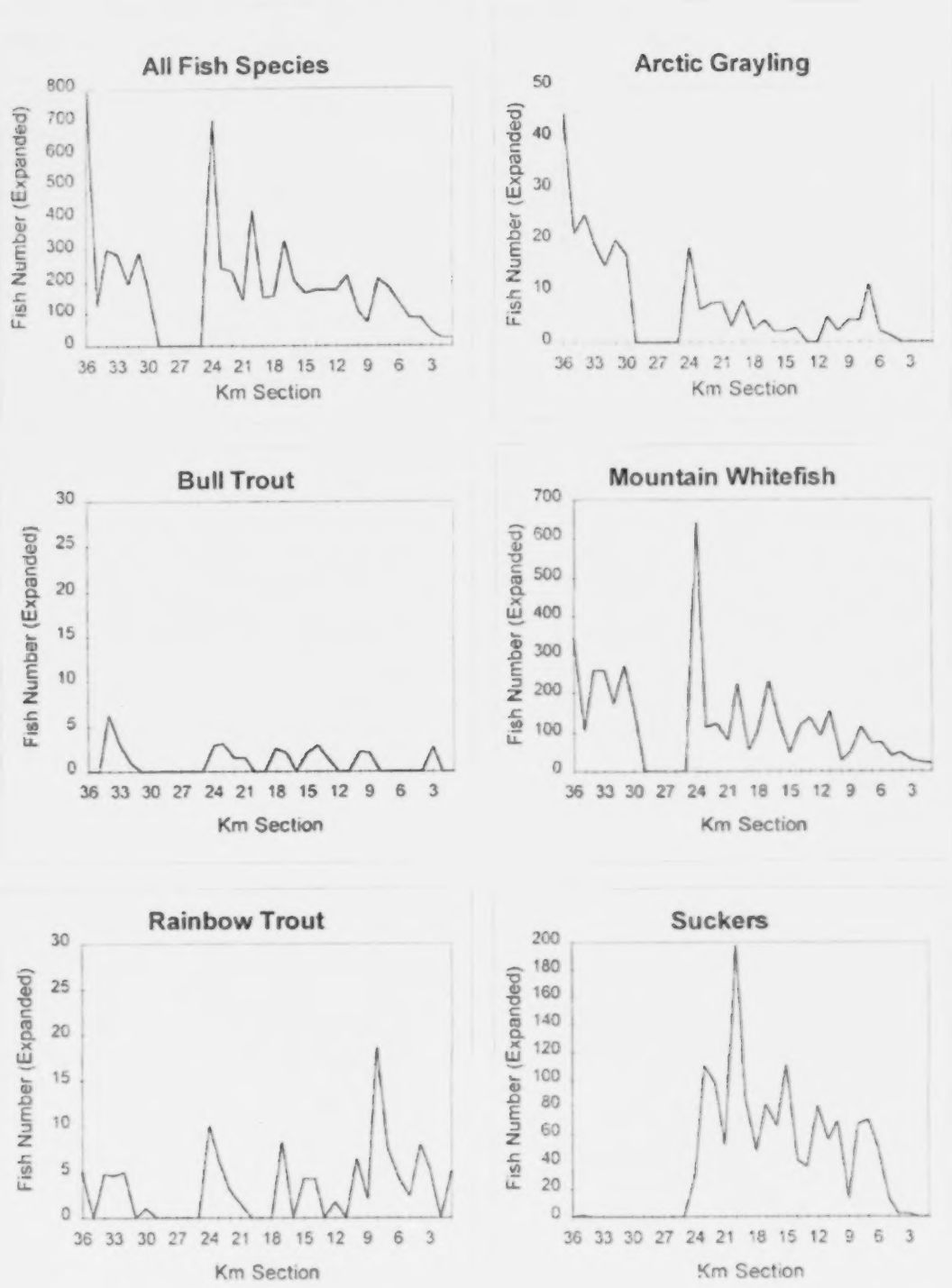

Figure 6. Estimated number of fish by kilometre section, Table River July 6 - 19, 1995.

Suckers (not identified to species) were observed (July 9) in high concentrations at two areas of the mainstem. A pronounced sucker specific spike occurred at the 20 km section. Very large schools of suckers were observed in this section. This one kilometre section is essentially a low gradient glide with no cover. The suckers may have recently completed spawning as Scott and Crossman (1973) indicate the spawning period of the coarse (large scale), longnose (fine scale), and white suckers is roughly May to the end of June. It is not known if the fish had spawned at this location or recently moved to it. In addition, a large school of suckers were observed at the 23 km section of the river immediately downstream of the bridge crossing. These fish were observed frequently at this location prior to the July 6 - 19 survey, this site may also be an important spawning location for suckers.

2. Sub sections (km 35.5 to km 32 and km 9.8 to km 5) underwater fish count.

A detailed underwater fish census (August 9 and 11) summary of the upper (km 35.5 to 32) and lower (km 9.8 to 5) river sites are presented in Tables B4 and B5 respectively (Appendix B). Table 5 summarises the number of fish observed of all species by area (ha) and stream length (km). No correction factors have been applied in Table 5; therefore, these numbers represent a conservative estimate of fish numbers. In the upper section the entire stream width was visually covered by the swimmers, therefore no fish "should" be missed and counts were not subject to visual limitation expansion factors. In the lower section only 21 metres of the 28 metre stream width was covered. Therefore an expansion factor of 1.33 was applied to the number of fish actually observed in the lower section to compensate for visual limitations.

Table 5. Estimated fish densities per unit area (ha) and distance (km).

	bull trout		Arctic grayling		mountain whitefish		northern squawfish		rainbow trout		suckers	
# fish per:	ha	km	ha	km	ha	km	ha	km	ha	km	ha	km
Upper Section	4.0	5.6	22.7	31.7	163	227.7	0.0	0.0	2.3	3.3	0.0	0.0
Lower Section	1.4	3.9	3.2	8.9	51.4	144.0	0.2	0.7	8.3	23.3	3.0	8.5

At the time of this survey (August) Arctic grayling, bull trout and mountain whitefish densities were highest in the upper section. Rainbow trout and sucker densities were highest in the lower section. This trend was also observed during the single pass survey of the entire river in early July.

Bull trout were observed in low numbers in both sections. However, a bull trout density of 2.33/ha (3.29/km) for fish in the 40+ cm size class was observed in the upper section as opposed to a 0.1/ha (0.4/km) density in the lower section (Appendix B, Tables B4 and B5), indicating a much higher use of the upper area by this size class. These large fish present in the upper section are probably spawners seeking out preferred spawning habitat, or "staging sites" prior to spawning as outlined by Haas 1997. McPhail and Baxter (1995) identified preferred habitat as having a predominance of small gravel (<20 mm diameter), relatively low water velocity (0.03-0.8 m/s), and proximity to cover. This preferred habitat was in greater abundance in the upper section as compared to the lower section. It is also

possible that these large piscivorous fish could also be remaining in this area after spawning to feed on the mountain whitefish and Arctic grayling. Some, or all, of the bull trout observed could represent a summer feeding population. The densities of Arctic grayling and whitefish are at least four times greater in the upper section as compared to the lower section (Table 5). Stewert et al. (1982) reported the diet of Adsett Creek bull tout consisted of grayling, whitefish and occasionally slimy sculpins. Bull trout immigration into Adsett Creek was associated with peak ascent of grayling and whitefish; bull trout emigrated when the abundance of these prey diminished (Stewert et al. 1982).

Correction factors to be applied to the expanded counts of Arctic grayling, bull trout, and rainbow trout were determined by the mark-recapture component of the fish census. The number of each species of fish tagged is presented in Table B6 (Appendix B). The calculation of correction factors by location and species is presented in detail in Table B6 (Appendix B). The correction factors are summarised in Table 6.

Table 6. Correction factors for BT, GR and RB.

	BT	GR	RB
Upper section	11.5	1.5	12.2
Lower section	1.8	3.4	3.7

As identified in Table B6 (Appendix B) only the correction factor of 1.5 for the upper section grayling is statistically valid. This 1.5 correction factor value indicates that the number of fish actually observed had to be multiplied by 1.5 to indicate the true number of fish present. Therefore, 50% of the Arctic grayling present were missed by the swimmers.

Too few fish were tagged and "recaptured" (observed) to provide statistically valid correction values for bull trout and rainbow trout in the upper section, and all species in the lower section (Appendix B, Table B6). The values presented in Table 6 (with the exception of Arctic grayling in the upper section) are for informational purposes only which must be used with caution.

Correction factors from Table 6 have been applied to the number of fish observed to provide an indication of actual (or corrected) fish densities in Table 7. As indicated previously, only the values for Arctic grayling in the upper section are statistically valid. The other values have been presented for informational purposes which may indicate the approximate level of fish densities. The "no correction factor applied" value in these cases may be used as a conservative value as they represent the minimum number of fish present. The densities with correction factors applied, although not statistically valid, may provide an indication of the range in which the true densities are found.

Table 7. Fish densities (expanded) with and without correction factors applied.

	BT		GR		RB	
# fish per:	ha	km	ha	km	ha	km
Upper section						
correction factor applied	**46.0**	**64.4**	**34.1**	**47.6**	**28.1**	**40.3**
(no correction factor applied)	(4.0)	(5.6)	(22.7)	(31.7)	(2.3)	(3.3)
Lower section						
correction factor applied	**2.5**	**7.0**	**10.9**	**30.3**	**30.7**	**86.2**
(no correction factor applied)	(1.4)	(3.9)	(3.2)	(8.9)	(8.3)	(23.3)

Bull trout and Arctic grayling densities are clearly highest in the upper section, while rainbow trout densities are highest in the lower section.

Adult Fish Samples

To facilitate the mark-recapture study, adult Arctic grayling, bull trout, and rainbow trout were captured, sampled, Floy tagged, and released. Sub-adult fish, which were captured by angling, are included in this section for ease of reporting. These fish were included in the data set because some of the age 2 rainbow trout were large enough to tag.

A total of 189 adult fish were captured and sampled. Thirteen fish were captured at the falls (37.6 km), the rest were captured within the two sub sections (upper and lower river sites). A total of 12 bull trout were captured and sampled within the two sub section sites (upper and lower river sites). Four additional bull trout were captured and sampled at the 37.6 km falls site. A total of 118 Arctic grayling were captured and sampled within the two sub section sites. An additional 6 were captured at the 37.6 km falls site. A total of 46 rainbow trout were captured and sampled within the two sub section sites. An additional 3 were captured at the falls site.

Detailed analysis of the fish samples is available in Fish Species Presence and Abundance Surveys of the Table River, 1995 (Zemlak and Langston 1998). A summary of the fish sample data is presented in Table 8. Mean lengths, weights, and age are presented for all samples, and separated by location (upper and lower site).

Arctic grayling in the upper river sub section were older and larger than those found in the lower section. This trend was not the same for bull and rainbow trout. The sample sizes of bull and rainbow trout were also too small to detect any trends.

Table 8. Mean lengths, weights, age and sample size (n) of fish by capture location.

Species	Location	Mean Length (mm)	Mean Weight (g)	Mean Age (years)
bull trout	lower river	395 (n=2)	552 (n=2)	4.5 (n=2)
	upper river	498(n=10)	1481 (n=10)	5.3 (n=7)
	overall	468(n=16)	1443 (n=13)	5.2 (n=13)
Arctic grayling	lower river	241 (n=34)	158 (n=34)	3.1 (n=34)
	upper river	309 (n=84)	345 (n=84)	4.8 (n=84)
	overall	289 (n= 124)	290 (n=117)	4.3 (n= 123)
rainbow trout	lower river	237 (n=36)	151 (n=36)	3.0(n=36)
	upper river	271 (n=10)	241 (n=10)	2.9 (n=9)
	overall	246 (n=49)	171 (n=46)	3.0 (n=48)

Arctic Grayling Habitat Preference

Arctic grayling were observed only in the mainstem of Table River from the mouth upstream to kilometre 37.6. The 2 m vertical waterfall at kilometre 37.6 is a barrier to upstream migration of Arctic grayling. No evidence of use of tributaries, side channels or back channel habitat was observed. No spawning activity was observed, and no locations of spawning identified.

Adult and sub-adult Arctic grayling were most often observed in small pools or glides containing at least some large woody debris. Details of the habitat grayling were utilising is presented in Table Bl (Appendix B). The grayling were usually not observed in the debris/cover, but a few metres to the side or behind the debris. Arctic grayling were usually situated very close to the thalweg through the pools, and stationed approximately 10 cm off the bottom. The mean water depth grayling (n=59) were located at was 126 cm (range 70 to 260 cm). Only sub-adult grayling were observed in water less than one metre deep. The mean velocity grayling (n=59) were located at was 0.36 m/sec (range 0 to 0.72 m/sec) reading taken 10 cm from the bottom.

The highest concentration of adult grayling observed was in the confluence pool of Tributary 605 and the Table River. The observations were made in July and August, after the suspected peak spawning period of May - June. Therefore it is not known if this site is a prime spawning area, or in close proximity to one. The site does appear to afford/represent optimal adult summer rearing (feeding) habitat.

The size of grayling was larger the further upstream they were located. This occurrence of larger and presumably older grayling in the upper reaches of a stream has been previously noted by Northcote (1978) and Tack (1980) and is believed to be a component of an Arctic grayling migratory sequence. This sequence suggests that the adult fish migrate to the upper reaches of the stream with sub-adult fish occupying the middle reaches of the river, and finally juveniles (age 1 +) inhabiting the lower reaches of the river.

There was an increase in the number of Arctic grayling observed in the upper (30 - 37.6 km) section of the mainstem (Fig. 6). The actual number of grayling may not have been highest in the upper river, instead it was probably the concentration of the larger fish that was highest there. The methodology used, underwater fish counts, is biased to larger fish as they are easier to observe than the smaller sub-adults. The grayling fry, which inhabit shore margins too shallow for swimmers to investigate, would never be accurately enumerated by swimmers performing an underwater fish count. Studies which used fish fences and traps to determine overall population composition, such as Craig and Poulin (1975) at Weir Creek, find grayling fry make up the bulk of a population. It is probable that larger numbers of smaller fish were present in lower sections of the Table River as found in Weir Creek. However, sampling techniques employed, sampling locations, and project timing were not adequate to accurately assess Arctic grayling juvenile and young of the year populations within the Table River drainage.

Thirteen young of the year Arctic grayling were captured by electrofishing the shoreline of the Table River from km 26 to km 27. The grayling were located in shallow water (10 cm or less) with primarily small cobble substrate, and little or no flow. The sites where grayling were found were usually associated with the downstream end of a long glide or pool, and just upstream of a riffle. This location, in particular one 60 m^2 site within it, contained the highest concentrations of age 0+ grayling encountered in the Table River watershed. Details of the site and fish captured are presented in "Fish species presence and abundance of the Table River, 1995" (Zemlak and Langston 1998). No examination of similar locations for fish presence was undertaken as the field activities ended shortly after discovery of this site.

It is important to note that the field work did not commence until July. Arctic grayling spawning likely occurs in mid-May, as observed in the Sukunka River by Stuart and Chislett (1979). Spawning may be completed by the end of May as suggested in a 1977 study of northeastern B.C. streams (Anonymous 1978). The peak for Arctic grayling spawning in Williston Reservoir tributaries may occur in June (Bruce and Starr 1985). Butcher et al. (1981) found grayling fry had moved downstream from spawning and early rearing tributaries into the mainstem of the Liard River by late June. These reports indicate the timing of the 1995 Table River field work was not appropriate for determining Arctic grayling spawning locations, or young of the year (age 0+) habitat use immediately post emergence.

Further information on preferred spawning locations, feeding, and overwintering habitat locations of adult Arctic grayling will be determined by a radio telemetry project to be initiated in the summer of 1996. An Arctic grayling genetics study will also be initiated in 1996. This project will determine if there are genetically unique grayling stocks within the Table River. If unique genetic stocks do occur within the Table River Arctic grayling population, specific protection measures may be required. In addition, rehabilitation of degraded habitat at locations found to be important/critical for each stock encountered may be necessary.

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APPENDIX A

(Habitat Survey Forms)

DFO / MOE
STREAM SURVEY FORM

Stream Name | Local | Access | Method
Watershed Code | Reach No. | Length(m) |
Location | Map# | Site No. | Lithsurv(m)
UTM | Fish Catd Y N C | Field ☐ Hist ☐
Date Y M D | Time | Agency | Crew | Photos | Air Photos

C	PARAMETER	VALUE	METH
	Ave.Chan.Width (m)		
	Ave Wet Width (m)		
	Ave Max Riffle Depth (cm)		
	Ave Max Pool Depth (cm)		
	Gradient %		
	% Pool	Riffle	Run	Other
	Side Chan %	0 ☐ 0-10 ☐ 10-40 ☐ 740 ☐	
	Debris Area%	0 ☐ 0-5 ☐ 5-15 ☐ >15 ☐	
	Stable %		
	COVER: Total %		
	Dom (with 100%)	Bedrock	Boulder	Cobble	Gravel	Sand/Fines
	Crown Closure %	C	Aspect

SPECIFIC DATA

C	BED MATERIAL	%
	Fines	Clay-Silt-Sand (<2mm)
	Gravels	small (2-16mm)
		large (16-64mm)
	Larges	sm cobble (64-128mm)
		lg cobble (128-256mm)
		boulder (>256mm)
	Bedrock (R)	
	D_{50} (cm)	C Compaction L M H

C	BANKS
	Height(m) % Unstable
	Texture F G L R
	Confinement EN CO FC OC UC N/A
	Valley Channel Ratio 0-2 2-5 5-10 10+ N/A
	Stage Dry L M H Flood
	Flood Signs Ht(m) Braided Y N
	Bars % pH Gradom
	Water Temp °C Turb(ntu) Cond 25°C

OBSTRUCTIONS			
C	Ht(m)	Type	Loc'n

DISCHARGE

Parameter	Value	Method	Specific Data
Wetted Width (m)			
Mean Depth (m)			
Mean Velocity (m/s)			
Discharge (m^3/s)			

REACH SYMBOL (Fish)

Width Valley Channel Slope Bed Material

REV. DEC 1987

FISH SUMMARY

C	Species	No.	Size Range (mm)	Life Phase	Use	Method/Ref.

STREAM/VALLEY CROSS-SECTION ☐ (Looking Downstream) L R

PLANIMETRIC VIEW ☐

COMMENTS

Channel Stability Debris Management Concerns Obstructions Riparian Zone Valley Wall Processes Etc.

Edited by

Date Y M D

For definition of all parameters present on this form, see Fish Habitat Inventory & Information Program Stream Survey Field Guide. (DFO/MOE).

Detailed Habitat Biophysical Form

STREAM: REACH: DATE/TIME: CREW:

LOCATION: W.T. =

T	L	WW	CW	$\bar{X}$D	MD	RC	EL	RS	RN	SP	D90	DS	SS	F	P	A	DP	LWD	SWD	BLD	CBK	OH	CC	C
																								1
																								2
																								3
																								4
																								5
																								6
																								7
																								8
																								9
																								10
																								11
																								12
																								13

COMMENTS

1. LWD-
2. LWD-
3. LWD-
4. LWD-
5. LWD-
6. LWD-
7. LWD-
8. LWD-
9. LWD-
10. LWD-
11. LWD-
12. LWD-
13. LWD-

Key for Detailed Habitat Biophysical Form

T - Habitat type (ie. glide, pool, riffle)
L - Length surveyed (m)
WW- Wetted stream width (m)
CW- Stream Channel Width (m)
XD- Mean depth of stream (cm)
MD- Maximum depth (m)
RC- Riffle crest (cm) applies only to pools
EL- Element (feature that creates pool)
RS- Rise (cm) (element of gradient)
RN- Run (m) (element of gradient)
SP- Percentage of useable spawning habitat
D90- Substrate diameter that is $\geq$ 90 % of stream substrate
DS- Dominant substrate present (ie. gravel, fines)
SS- Subdominant substrate present (ie. gravel, fine)
F- Percentage of area suitable for fry.
P- Percentage of habitat suitable for parr.
A- Percentage of habitat suitable for adults.
DP- Percentage of cover provided by deep pools.
LWD- Percentage of cover provided by large woody debris.
SWD- Percentage of cover provided by small woody debris.
BLD- Percentage of cover provided by boulders.
CBK- Percentage of cover provided by cutbanks.
OH- Percentage of cover provided by overhanging vegetation ($\leq$ 1 m above stream)
CC- Percentage of crown closure.
C- Comment code
#LWD- count of LWD pieces in three diameter size classes:
1) 10 - 20 cm
2) 20 - 50 cm; and,
3) >50 cm

APPENDIX B

(Detailed Fish Data)

GRAYLING HABITAT USE

Table B1. Arctic grayling habitat use.

LOCATION	HABITAT	DEPTH	VELOCITY			SUBSTRATE		COMMENTS
(km point)	TYPE	(cm)	10 cm	60%	Surface	Dominant	Subdominant	
9.1	glide	155	0.42	0.46	0.58	sand	gravel	LWD 7m from left bank
9.1	glide	138	0.54	0.5	0.63	gravel	sand	LWD 5 m from left bank
9	pool	150	0.4	0.54	0.62	gravel	cobble	debris jam
9	pool	180	0.23	0.05	0.21	gravel	cobble	debris jam
8.4	pool	150	0.33	0.55	0.36	sand	gravel	
8	run	115	0.56	1	1.08	gravel	sand	
8	pool	170	0.33	0.1	1.28	sand	sand	
8	pool	205	0.15	0.32	0.19	gravel	sand	
7.9	glide	70	0.28	0.63	0.6	cobble	gravel	
7.7	glide	110	0.54	1.05	0.82	gravel	cobble	
7.6	glide	118	0.72	1.18	0.88	cobble	gravel	LWD 1 m from right bank
7.5	glide	165	0.26	0.69	0.62	gravel	cobble	LWD 1 m from right bank
7.5	glide	125	0	1.16	0.37	cobble	gravel	LWD at fish location
7.9	glide	73	0.47	0.82	0.72	gravel	sand	grayling was 12 cm (part of school of 2)
7.9	glide	73	0.47	0.82	0.72	gravel	sand	grayling was 12 cm (part of school of 2)
7.7	glide	108	0.63	1.18	1.02	gravel	sand	grayling was 12 cm (part of school of 8)
7.7	glide	108	0.63	1.18	1.02	gravel	sand	grayling was 12 cm (part of school of 8)
7.7	glide	108	0.63	1.18	1.02	gravel	sand	grayling was 12 cm (part of school of 8)
7.7	glide	108	0.63	1.18	1.02	gravel	sand	grayling was 12 cm (part of school of 8)
7.7	glide	108	0.63	1.18	1.02	gravel	sand	grayling was 12 cm (part of school of 8)
7.7	glide	108	0.63	1.18	1.02	gravel	sand	grayling was 12 cm (part of school of 8)
7.7	glide	108	0.63	1.18	1.02	gravel	sand	grayling was 12 cm (part of school of 8)
7.5	pool	110	0.11	0.01	0	cobble	gravel	grayling was 23 cm
8.8	glide	120	0.37	0.75	0.65	cobble	gravel	grayling was 17 cm
5.9	glide	140	0.27	0.68	0.47	gravel	cobble	grayling was 26 cm
5.7	glide	90	0.69	0.86	0.79	gravel	cobble	grayling was 12 cm
5.4	glide	46	0.62	0.82	0.61	gravel	sand	grayling was 10 cm
35.5	pool	135	0.4	0.55	0.35			
35.4	pool	130	0.25	0.45	0.51			one of 4 adult grayling here
35.4	pool	130	0.25	0.45	0.51			one of 4 adult grayling here
35.4	pool	130	0.25	0.45	0.51			one of 4 adult grayling here
35.4	pool	130	0.25	0.45	0.51			one of 4 adult grayling here
35.15	pool	120	0.31	0.42	0.27			one of six adult grayling
35.15	pool	120	0.31	0.42	0.27			one of six adult grayling
35.15	pool	120	0.31	0.42	0.27			one of six adult grayling
35.15	pool	120	0.31	0.42	0.27			one of six adult grayling
35.15	pool	120	0.31	0.42	0.27			one of six adult grayling
35.15	pool	120	0.31	0.42	0.27			one of six adult grayling
35.1	pool	125	0.3	0.73	0.76			one of five adult grayling
35.1	pool	125	0.3	0.73	0.76			one of five adult grayling
35.1	pool	125	0.3	0.73	0.76			one of five adult grayling
35.1	pool	125	0.3	0.73	0.76			one of five adult grayling
35.1	pool	125	0.3	0.73	0.76			one of five adult grayling
34.5	pool	125	0.05	0.05	0.06			
34.3	pool	150	0.11	0.4	0.3			one of six adult grayling
34.3	pool	150	0.11	0.4	0.3			one of six adult grayling
34.3	pool	150	0.11	0.4	0.3			one of six adult grayling
34.3	pool	150	0.11	0.4	0.3			one of six adult grayling
34.3	pool	150	0.11	0.4	0.3			one of six adult grayling
34.3	pool	150	0.11	0.4	0.3			one of six adult grayling
34.3	pool	260	0.28	0.2	0.2			one of four adult grayling
34.3	pool	260	0.28	0.2	0.2			one of four adult grayling
34.3	pool	260	0.28	0.2	0.2			one of four adult grayling
34.3	pool	260	0.28	0.2	0.2			one of four adult grayling
34.3	pool	150	0.45	0.64	0.45			one of four adult grayling
34.3	pool	150	0.45	0.64	0.45			one of four adult grayling
34.3	pool	150	0.45	0.64	0.45			one of four adult grayling
34.3	pool	150	0.45	0.64	0.45			one of four adult grayling
	Means =	136.1	0.359	0.623	0.553			

Table B2. Table River Electrofishing Summary

STREAM NAME	DATE (y/m/d)	REACH #	SITE U.T.M.	WATER TEMP. (°C)	SURFACE AREA (m^2)	METHOD	SPECIES	# OF FISH CAP.	# OF EST. FISH	X FL (mm)	FL RANGE (mm)	X WT (g)	WT RANGE (g)	POP DENSITY (# / m^2)	EST. BIOMASS (g / m^2)
Mainstem (3.8 km)	950909	1	10.54712.606290	?	96	P.E.	BB	1	1**	-	-	-	-	0.010	-
(right bank/shoreline)	"	"	"	"	"	"	CC	4	4	-	-	-	-	0.042	-
Mainstem (3.8 km)	950909	1	10.54712.606290	?	176	P.E.	CC	5	6	-	-	-	-	0.034	-
(left bank/shoreline)	"	"	"	"	"	"	MW	1	1**	55	-	1.2	-	0.006	0.007
	"	"	"	"	"	"	RB 0+	1	1**	38	-	0.6	-	0.006	0.003
	"	"	"	"	"	"	SU	1	1**	-	-	-	-	-	-
Tributary 072	950823	1	10.54737.606320	9.5	625	P.A.	NONE	0	N/A	-	-	-	-	N/A	N/A
Tributary 154	950830	2	10.55000.606475	9.0	360	P.E.	RB 0+	14	16	40	37 - 42	0.7	0.5 - 1.3	0.044	0.031
	"	"	"	"	"	"	RB	16	16	95	78 - 135	9.6	5.1 - 26.7	0.044	0.427
	"	"	"	"	"	"	SU	1	1**	120	-	0.7	-	0.003	0.002
Tributary 154	950831	3	10.55010.606496	7.0	524	P.E.	NONE	0	0	-	-	-	-	0.000	0.000
Tributary 163	950829	-	10.55109.606425	8.0	100	P.E.	NONE	0	0	-	-	-	-	0.000	0.000
Mainstem (9.6 km)	950910	1	10.55051.606475	?	90	P.E.	CC	39	45	-	-	-	-	0.500	-
(right bank/shoreline)															
Mainstem (9.6 km)	950910	1	10.55051.606475	?	96	P.E.	CC	8	9	-	-	-	-	0.094	-
(left bank/shoreline)															
Mainstem	950829	2	10.55305.606620	-	2,750	P.A.	MW	6	N/A	90	44 - 175	13	0.9 - 58.8	N/A	N/A
(11.0 to 17.0 km)	"	"	"	"	"		RB 0+	2	"	33	30 - 36	0.9	-	"	"
	"	"	"	"	"	"	RB	2	"	126	120 - 132	22.9	-	"	"
Tributary 199	950829	-	10.55215.606490	7.0	240	P.E.	NONE	0	0	-	-	-	-	0	0
Tributary 257	950830	-	10.55360.606685	9.0	400	P.E.	SU	2	2**	-	-	-	-	0.005	-
Tributary 257	950830	-	10.55375.606757	8.0	165	P.A.	NONE	0	N/A	-	-	-	-	N/A	N/A
Tributary 293	950817	1	10.55445.606815	8.0	5,913	P.A.	BT	1	N/A	153	-	32.8	-	N/A	N/A
	"	"	"	"	"	"	RB	1	"	89	-	7.6	-	"	"
Tributary 293	950906	1	10.55475.606737	9.0	600	P.E.	BT	3	3*	69	68 - 70	3.3	3.0 - 3.5	0.005	0.017
	"	"	"	"	"	"	CC	78	103	-	-	-	-	0.172	-
	"	"	"	"	"	"	RB 0+	22	22	38	32 - 43	0.6	0.4 - 0.8	0.037	0.022
	"	"	"	"	"	"	RB	14	14*	129	91 - 186	31	7.9 - 85	0.023	0.723

Table B2. Table River Electrofishing Summary

STREAM NAME	DATE (y/m/d)	REACH #	SITE U.T.M.	WATER TEMP. (°C)	SURFACE AREA (m^2)	METHOD	SPECIES	# OF FISH CAP.	# OF EST. FISH	X FL (mm)	FL RANGE (mm)	X WT (g)	WT RANGE (g)	POP. EST. DENSITY (# / m^2)	POP. EST. BIOMASS (g / m^2)
Tributary 353	950921	1	10.55715.606719	-	483	P.E.	CC	16	24	-	-	-	-	0.050	-
	"	"	"	"	"	"	RB 0+	6	6	39	32 - 45	0.9	0.7 - 1.1	0.012	0.011
Tributary 404	950823	1	10.55895.606783	7.5	660	P.A.	CC	1	N/A	-	-	-	-	N/A	N/A
	"	"	"	"	"	"	RB 0+	4	"	28	-	-	-	"	"
Mainstem (22.6 km)	950920	2	10.55892.606792	-	50	P.E.	CC	12	12	-	-	-	-	0.240	-
Mainstem (22.8 km)	950912	2	10.55892.606810	10.5	660	P.A.	BB	2	N/A	-	-	-	-	N/A	N/A
	"	"	"	"	"	"	CC	26	"	-	-	-	-	"	"
Tributary 427	950815	1	10.55926.606878	-	200	P.E.	CC	1	1*	-	-	-	-	0.005	-
Tributary 427	950816	-	10.55882.606930	-	720	P.A.	CC	4	N/A	-	-	-	-	N/A	N/A
Tributary 427	950831	1	10.55913.606891	8.5	2,000	P.A.	BT	1	N/A	90	-	-	-	N/A	N/A
	"	"	"	"	"	"	CC	10	"	-	-	-	-	"	"
	"	"	"	"	"	"	MW	5	"	-	-	-	-	"	"
	"	"	"	"	"	"	RB 0+	5	"	-	-	-	-	"	"
	"	"	"	"	"	"	sp ?	1	"	20	-	-	-	"	"
Tributary 431	950824	-	10.56154.606942	8.0	624	P.A.	NONE	0	N/A	-	-	-	-	N/A	N/A
Tributary 431	950908	1	10.55969.606885	11.0	300	P.A.	SU	12	N/A	46	-	-	-	N/A	N/A
Mainstem (26.0 to 27.0 km)	950928	1 & 2	10.56022.607029	9.0	5,000	P.A.	BB	1	N/A	-	-	-	-	N/A	N/A
	"	"	"	"	"	"	BT 0+	16	"	68	59 - 79	3.1	1.9 - 4.4	"	"
	"	"	"	"	"	"	GR 0+	13	"	65	59 - 71	2.2	1.5 - 2.8	"	"
	"	"	"	"	"	"	RB 0+	4	"	47	41 - 56	1.1	0.7 - 1.8	"	"
	"	"	"	"	"	"	RB	2	"	166	126 - 205	33.5	21.4 - 45.6	"	"
Mainstem (26.5 km)	950928	1	10.56023.607030	9.0	112	P.A.	BB	1	N/A	200	-	44.4	-	N/A	N/A
	"	"	"	"	"	"	SU	1	"	97	-	9.2	-	"	"
Tributary 496	950908	1	10.56232.606969	-	660	P.E.	BB	5	5	185	156 - 235	37.9	22.3 - 69.5	0.008	0.287
	"	"	"	"	"	"	CC	52	112	-	-	-	-	0.170	-
	"	"	"	"	"	"	MW	1	1*	143	-	29.1	-	0.002	
	"	"	"	"	"	"	RB	2	2	174	164 - 183	57.9	40.4 - 75.3	0.003	0.175
Tributary 496	950929	4	10.56809.606786	Electroshocker not working, no attempt at shocking. Identified one dead bull trout on shore.											

Table B2. Table River Electrofishing Summary

STREAM NAME	DATE (y/m/d)	REACH #	SITE U.T.M.	WATER TEMP. (°C)	SURFACE AREA (m^2)	METHOD	SPECIES	# OF FISH CAP.	# OF EST. FISH	X FL (mm)	FL RANGE (mm)	X WT (g)	WT RANGE (g)	POP. EST. DENSITY (# / m^2)	POP. EST. BIOMASS (g / m^2)
Tributary 527	950929	1	10.56242.607150	7.5	520	P.E.	BB	1	1**	210	-	59	-	0.002	0.113
	"	"	"	"	"	"	BT	1	1**	63	-	3	-	0.002	0.006
	"	"	"	"	"	"	CC	74	138	-	-	-	-	0.265	-
	"	"	"	"	"	"	MW	2	2*	73	70 - 75	2.6	2.3 - 2.8	0.004	0.010
	"	"	"	"	"	"	RB 0+	1	1*	84	-	4.5	-	0.002	0.009
	"	"	"	"	"	"	RB	1	1*	95	-	6.5	-	0.002	0.013
Mainstem (34.1 km)	950926	3	10.56470.607380	7.5	250	P.E.	BB	4	4	192.5	170 - 220	42.7	29 - 63.1	0.016	0.683
	"	"	"	"	"	"	CC	92	128	-	-	-	-	0.512	-
	"	"	"	"	"	"	MW	1	1*	60	-	2.4	-	0.004	0.010
Mainstem (34.1 to 34.5 km)	950926	3	10.56485.607399	-	500	P.A.	CC	many	N/A	200	-	-	-	N/A	N/A
	"	"	"	"	"	"	RB	2	"	150	-	-	-	"	"
Tributary 605	950824	1	10.56475.607416	7.5	2,750	P.A.	BT 0+	9	N/A	44	34 - 50	0.9	0.3 - 1.3	N/A	N/A
	"	"	"	"	"	"	BT	3	"	126	88 - 197	27.7	5.8 - 70	"	"
	"	"	"	"	"	"	RB 0+	2	"	48	40 - 56	1.4	0.6 - 2.2	"	"
	"	"	"	"	"	"	TR	1	"	20	-	-	-	"	"
Tributary 610	950901	1	10.56555.607481	-	550	P.E.	BB	11	16	215	172 - 240	57.9	34 - 82.4	0.029	1.684
	"	"	"	"	"	"	BT	2	2*	185	185 - 185	65.1	63.5 - 66.7	0.004	0.237
	"	"	"	"	"	"	CC	178	236	-	-	-	-	0.429	-
	"	"	"	"	"	"	MW	1	1**	64	-	2.1	-	0.002	0.004
	"	"	"	"	"	"	RB	2	2	209	195 - 222	109.6	84.2 - 135	0.004	0.399
Tributary 610	950901	1	10.56595.607588	-	4,500	P.A.	CC	25	N/A	-	15 - 90	-	-	N/A	N/A
	"	"	"	"	"	"	MW	1	"	45	-	-	-	"	"
	"	"	"	"	"	"	RB	1	"	160	-	-	-	"	"
Tributary 626	950822	1	10.56564.607380	-	1,056	P.E.	BT 0+	10	12	48	44 - 55	1.5	0.7 - 2.3	0.011	0.017
	"	"	"	"	"	"	BT	15	15	99	84 - 160	18.2	5.6 - 143	0.014	0.259
	"	"	"	"	"	"	CC	8	40	49	30 - 90	2.3	0.3 - 8.6	0.038	0.087
	"	"	"	"	"	"	RB 0+	6	6	41	26 - 68	2	0.6 - 5	0.006	0.011
	"	"	"	"	"	"	RB	22	28	92	69 - 147	10.8	3.8 - 37.9	0.027	0.286
Tributary 626	950822	2	10.56671.607261	-	835	P.A.	BT	2	N/A	125	-	-	-	N/A	N/A
Mainstem (35.6 km)	950818	4	10.56594.607377	-	3,500	P.A.	BB	2	N/A	209	184 - 234	50.3	29.8 - 70.7	N/A	N/A
	"	"	"	"	"	"	BT	3	"	155	107 - 189	42.9	14.7 - 71.3	"	"
	"	"	"	"	"	"	RB	3	"	130	116 - 154	27.6	17.1 - 38	"	"

Table B2. Table River Electrofishing Summary

STREAM NAME	DATE (y/m/d)	REACH #	SITE U.T.M.	WATER TEMP. (°C)	SURFACE AREA (m^2)	METHOD	SPECIES	# OF FISH CAP.	# OF EST. FISH	X FL (mm)	FL RANGE (mm)	X WT (g)	WT RANGE (g)	POP. EST. DENSITY (# / m^2)	POP. EST. BIOMASS (g / m^2)
Mainstem (38.5 km)	950927	4	10.56818.607388	7.5	287	P.E.	BT 0+	3	3	78	75 - 80	4.6	4.3 - 4.9	0.010	0.048
	"	"	"	"	"	"	BT	2	2	134	130 - 137	22.4	21.7 - 23	0.007	0.156
	"	"	"	"	"	"	CC	38	66	-	-	-	-	0.230	-
Mainstem (50.8 km)	950929	6	10.57754.607521	7.0	261	P.E.	BT	1	1*	55	-	1.6	-	0.004	0.006
Mainstem (50.8 km)	950929	6	10.57754.607521	7.0	1,160	P.A.	BT 0+	2	N/A	55	55 - 55	1.5	1.1 - 1.9	N/A	N/A
	"	"	"	"	"	"	BT	7	"	200	105 - 260	104.1	9.7 -189.7	"	"
Mainstem (54 km)	950815	7	10.58040.607670	6.0	210	P.A.	BT	1	N/A	196	-	-	-	N/A	N/A

"# OF EST. FISH" - indicates a population estimate using the Microfish 3.0 Program.

"# OF EST. FISH*" - indicates a population estimate using the following equation:
N = A/((1-B)/A), where A = the number of fish removed (captured) on the first pass, and
B = the number of fish removed (captured) on the second pass.

"# OF EST. FISH**" - indicates a population error (a maximum-likelihood estimation is not possible due to only 1 fish being caught on all passes.
- as a result, the population estimate was based on the actual number of fish captured.

" - " indicates that a length or weight was not taken for a certain fish or that a water temperature was not taken.

Table B2. Table River Electrofishing Summary

KEY FOR THE ELECTROFISHING SUMMARY — TABLE RIVER

STREAM NAME	DATE (y/m/d)	REACH #	SITE U.T.M.	WATER TEMP. (°C)	SURFACE AREA (m^2)	METHOD	SPECIES	# OF FISH CAP.	# OF EST. FISH	X FL (mm)	FL RANGE (mm)	XWT (g)	WT RANGE (g)	POP. EST. DENSITY (# / m^2)	POP. EST. BIOMASS (g)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

1) "STREAM NAME" - Gazetted or alias stream name.

2) "DATE" - Date of the survey entered in the form of YMD (year, month, day).

3) "REACH" - The homogeneous section of stream where the survey occurred.

4) "U.T.M. SITE" - (Universal Transverse Mercator) number that identifies the location of the sampling site.

5) "WATER TEMP." - The temperature of the water expressed in degrees Celsius at the time of the survey using a hand held alcohol thermometer.

6) "SURFACE AREA" - The surface area of stream sampled expressed in square metres.

7) "METHOD" - The method used to determine fish presence.
- ie. P.A. = Presence / Absence - no stop nets used, open site.
P.E. = Population Estimate - stop nets used, closed site, minimum 2 pass removal method.

8) "SPECIES" - Indicates the species code of fish captured. An age of 0+ indicates young of the year fish.
- ie. BB = burbot
BT 0+ = bull trout, young of the year
BT = bull trout, one year and older
CC = sculpins (general)
GR 0+ = Arctic grayling, young of the year
LNS = longnose sucker
MW = mountain whitefish
RB 0+ = rainbow trout, young of the year
RB = rainbow trout, one year and older
sp ? = unknown species
SU = sucker (general)
TR = trout (general)

9) "# OF FISH CAP." - The number of fish captured during sampling.

10) "# OF EST. FISH" - The number of estimated fish in a certain area using the Microfish 3.0 Program based on the # of fish captured. Fish estimates are only determined for P.E..

11) "X FL" - The mean fork length of a fish expressed in millimetres.

12) "FL RANGE" - The range of fork lengths from the smallest to the largest expressed in millimetres.

13) "X WT" - The mean weight of a fish expressed in grams.

14) "WT RANGE" - The range of weights from the smallest to the largest expressed in grams.

15) "POP. EST., DENSITY" - The number of estimated fish for an area divided by the surface area and is expressed in the number of fish per square metre.

16) "POP. EST., BIOMASS" - The density divided by the mean fish weight and is expressed in grams of fish per square metre.

Table B3. Single Pass Underwater Fish Count Results.

Location	Width	Visibility	Observed Fish Count							Expanded Fish Count						
(km)	(m)	(m)	BT	GR	MW	RB	SU	NSC	Total/km	BT	GR	MW	RB	SU	NSC	Total/km
36	20	4	0	18	138	2	0	0	316	0	45.0	345	5.0	0.0	0.0	790.0
35	20	4	0	17	84	0	1	0	102	0	21.3	105	0	1.3	0	127.5
34	25	4	4	16	167	3	0	0	190	6.3	25.0	261	4.7	0	0	296.9
33	24	4	2	13	173	3	0	0	191	3	19.5	260	4.5	0	0	286.5
32	16	4	1	15	173	5	0	0	194	1	15.0	173	5	0	0	194.0
31	20	4	0	16	217	0	0	0	233	0	20.0	271	0	0	0	291.3
30	15	4	0	17	162	1	0	0	180	0	17.0	162	1	0	0	180.0
29	17		0	0	0	0	0	0	0	0	0.0	0	0	0	0	0.0
28	22		0	0	0	0	0	0	0	0	0.0	0	0	0	0	0.0
27	25		0	0	0	0	0	0	0	0	0.0	0	0	0	0	0.0
26	19		0	0	0	0	0	0	0	0	0.0	0	0	0	0	0.0
25	20		0	0	0	0	0	0	0	0	0.0	0	0	0	0	0.0
24	20	3.5	2	13	448	7	21	0	491	2.9	18.6	640	10	30	0	701.4
23	22	3.5	2	4	72	4	70	0	152	3.1	6.3	113	6.3	110	0	238.9
22	21	3.5	1	5	81	2	65	0	154	1.5	7.5	122	3	98	0	231.0
21	22	3.5	1	5	50	1	33	0	90	1.6	7.9	78.6	1.6	52	0	141.4
20	30	2.5	0	1	75	0	66	0	142	0	3.0	225	0	198	0	426.0
19	27	2.5	0	3	20	0	32	0	55	0	8.1	54	0	86	0	148.5
18	25	2.5	1	1	41	0	19	0	62	2.5	2.5	103	0	48	0	155.0
17	25	3	1	2	112	4	39	0	158	2.1	4.2	233	8.3	81	0	329.2
16	27	3	0	1	60	0	29	0	90	0	2.3	135	0	65	0	202.5
15	25	3	1	1	22	2	53	0	79	2.1	2.1	45.8	4.2	110	0	164.6
14	17	3	2	2	85	3	29	0	121	2.8	2.8	120	4.3	41	0	171.4
13	18	3	1	0	92	0	24	0	117	1.5	0.0	138	0	36	0	175.5
12	21	3	0	0	53	1	46	0	100	0	0.0	92.8	1.8	81	0	175.0
11	30	3	0	2	62	0	22	1	87	0	5.0	155	0	55	2.5	217.5
10	30	3.5	1	1	13	3	32	0	50	2.1	2.1	27.9	6.4	69	0	107.1
9	29	3.5	1	2	22	1	6	2	34	2.1	4.1	45.6	2.1	12	4.1	70.4
8	29	3.5	0	2	55	9	32	1	99	0	4.1	114	19	66	2.1	205.1
7	26	3.5	0	6	38	4	38	9	95	0	11.1	70.6	7.4	71	17	176.4
6	31	3.5	0	1	34	2	23	2	62	0	2.2	75.3	4.4	51	4.4	137.3
5	17	3.5	0	1	32	2	11	24	70	0	1.2	38.9	2.4	13	29	85.0
4	32	3	0	0	18	3	1	10	32	0	0.0	48	8	2.7	27	85.3
3	32	3	1	0	11	2	1	2	17	2.7	0.0	29.3	5.3	2.7	5.3	45.3
2	30	3	0	0	9	0	0	0	9	0	0.0	22.5	0	0	0	22.5
1	31	3	0	0	8	2	0	0	10	0	0.0	20.7	5.2	0	0	25.8

Table B4. Table River population estimate snorkel survey, Upper Section (km 35.5 to km 32), August 9, 1995.

Table River Swim Count 1995 — Upper Section

Visibility = 5 m — Length of Reach = 3.8 km — Ave. width = 14.0 m — Area = 4.9 ha — # Swimmers = 2

Date: swim 1: Aug 9, 95

Date: swim 2: Aug 9, 95

Swim #1

	0-10 cm				10-20 cm				20-30 cm								30-40 cm								40-50 cm								50-60 cm		60-70 cm		total	total	total	total RB,GR	total	total	total
									RB		GR		BT				RB		GR		BT				RB		GR		BT				BT		BT							
Zone	RB	GR	BT	MW	RB	GR	BT	MW	RB	tags	GR	tags	BT	tags	MW	RB	RB	tags	GR	tags	BT	tags	MW	RB	RB	tags	GR	tags	BT	tags	MW	BT	tags	BT	tags	RB	GR	BT	&BT	MW	SU	NSC
RS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNS	0	0	0	345	0	0	0	0	4	0	28	17b	1	0	0	1	0	20	8b	1	0	0	0	0	0	8	0	2	0	0	0	1	0	0	0	5	62	13	70	343	0	0
RM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LNS	0	0	0	575	0	0	0	0	2	0	14	1c,3b	2	0	0	1	0	33	26b	1	0	0	0	0	0	2	1b	0	0	0	0	0	0	3	55	8	66	575	0	0
LS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	918	0	0	0	0	6	0	42	18	3	0	0	2	0	53	34	2	0	0	0	0	0	10	1	2	0	0	0	1	0	0	0	10	70	13	136	918	0	0

Note: whitefish numbers are totals...no size breakdown was undertaken

Swim #2

	0-10 cm				10-20 cm				20-30 cm								30-40 cm								40-50 cm								50-60 cm		60-70 cm		total	total	total	total RB,GR	total	total	total
									RB		GR		BT				RB		GR		BT				RB		GR		BT				BT		BT							
Zone	RB	GR	BT	MW	RB	GR	BT	MW	RB	tags	GR	tags	BT	tags	MW	RB	RB	tags	GR	tags	BT	tags	MW	RB	RB	tags	GR	tags	BT	tags	MW	BT	tags	BT	tags	RB	GR	BT	&BT	MW	SU	NSC
RS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNS	0	0	0	248	0	0	0	0	5	0	10	2b	5	0	0	3	0	38	20b	1	0	0	0	0	0	9	2b	1	0	0	0	1	0	0	0	12	64	9	75	248	0	0
RM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LNS	0	0	0	390	0	0	0	0	2	0	24	1c,11b	0	0	0	1	0	37	25b	1	0	0	0	0	0	3	0	0	0	0	0	4	0	5	0	3	61	9	73	390	0	0
LS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	638	0	0	0	0	11	0	34	13	5	0	0	4	0	75	45	2	0	0	0	0	0	12	2	1	0	0	0	5	0	0	0	15	125	18	148	638	0	0

Note: whitefish numbers are totals...no size breakdown was undertaken

SUMMARY

Expansion factor = 1.00 = Total channel width / channel width covered

Expanded Results	0-10 cm				10-20 cm				20-30 cm				30-40 cm				40-50 cm				50-60 cm	50-70 cm				total RB,GR			
	RB	GR	BT	MW	RB	GR	BT	MW	RB	GR	BT	MW	RB	GR	BT	MW	RB	GR	BT	MW	BT	BT	total RB	total GR	total BT	&BT	total MW	total SU	total NSC
Total for swim 1	0	0	0	918	0	0	0	0	6	42	18	0	2	53	34	0	0	8	2	0	10	0	8	107	21	136	918	0	0.0
Total for swim 2	0	0	0	638	0	0	0	0	11	34	18	0	4	75	2	0	0	8	8	0	0	0	15	115	18	148	638	0	0.0
Mean swim 1&2	0.0	0.0	0.0	787.0	0.0	0.0	0.0	0.0	8.5	38.0	9.0	0	3.0	87.5	3.0	0.0	0.0	5.5	3.5	0.0	5.0	0.0	12	111	20	142	787	0	0.0
Standard Error	0.0	0.0	0.0	121.0	0.0	0.0	0.0	0.0	2.5	4.0	0.0	0.0	1.0	9.5	1.0	0.0	0.0	0.50	1.5	0.0	2.0	0.0	3.5	4.0	1.5		121.0	0.0	0.0
Maximum	0.0	0.0	0.0	227.7	0.0	0.0	0.0	0.0	2.4	10.9	1.4	0.0	0.8	19.3	0.9	0.0	0.0	1.6	1.0	0.0	2.3	0.0	3.3	31.7	5.6	40.6	227.7	0.0	0.0
Standard Error	0.00	0.00	0.00	34.57	0.00	0.00	0.00	0.00	0.71	1.14	0.00	0.00	0.29	2.62	0.29	0.00	0.00	0.14	0.43	0.00	0.6	0.00	1.00	1.14	0.43		34.57	0.00	0.0
Steelrite	0.00	0.0	0.0	182.7	0.0	0.0	0.0	0.0	1.7	7.8	1.0	0.0	0.6	13.8	0.6	0.0	0.00	1.1	0.7	0.0	1.6	0.00	2.3	22.7	4.0	29.0	182.7	0.0	0.0
Standard Error	0.00	0.00	0.00	24.69	0.00	0.00	0.00	0.00	0.51	0.82	0.00	0.00	0.20	1.73	0.20	0.00	0.00	0.10	0.21	0.00	0.4	0.00	0.71	0.82	0.31		24.69	0.00	0.0

Equal or > 20 cm				
total RB	total GR	total BT	RB,GR & BT total
9	107	21	135
15	115	18	148
11.5	111.0	19.5	142.0
3.5	4.0	1.5	
3.3	31.7	5.6	40.6
1.0	1.1	0.4	
2.3	22.7	4.0	29.0
0.3	0.8	0.3	

- total count for each swim was obtained by expanding the mid lane counts (sum RNS, RM, LM, and LNS) x exp. factor, and adding the shore lane (RS, LS) counts.
- sucker and squawfish counts are restricted to individuals equal and more than 20 cm in length.
- a table is included (lower right side) with total rainbow trout, Arctic grayling and bull trout equal and more than 20 cm in order to compare the swim counts with mark-recapture estimates.

RS - Right shore — RNS - Right near shore — RM - Right mid-channel — LM - Left mid-channel — LNS - Left near shore — LS - Left shore — RB - rainbow trout — GR - Arctic grayling — BT - bull trout — MW - mountain whitefish — SU - sucker species — NSC - northern squawfish

Table River Upper Site
Mark Recapture Estimates
N = (M +1)(C + 1)/(R+1)
N = population estimate
M = number of fish tagged
C = number of fish observed
R = number of tagged fish observed

Swim #1		Swim #2	
Arctic grayling	170	Arctic grayling	159
rainbow trout	99	rainbow trout	176
bull trout	242	bull trout	209

84 blue tagged GR - 4% (hooking mortality) = 81 (rounded from 80.64)
10 blue tagged RB - 4% (hooking mortality) = 10 (rounded from 9.6)
10 blue tagged BT - 4% (hooking mortality) = 10 (rounded from 9.6)

Table B5. Table River population estimate snorkel survey, Lower Section (km 9.8 to km 5), August 11, 1995.

Table River Swim Count 1995 — Lower Section

Visibility = 3.5 m | Length of Reach = 4.8 km | Ave. width = 28.0 m | Area = 13.4 ha | # Swimmers = 1 | Date, swim 1: Aug 11, 95 | Date, swim 2: Aug 11, 95

Swim #1

Lane	0-10 cm RB	0-10 cm GR	0-10 cm BT	0-10 cm MW	10-20 cm RB	10-20 cm GR	10-20 cm BT	10-20 cm MW	20-30 cm RB	20-30 cm RB tags	20-30 cm GR	20-30 cm GR tags	20-30 cm BT	20-30 cm BT tags	20-30 cm MW	30-40 cm RB	30-40 cm RB tags	30-40 cm GR	30-40 cm GR tags	30-40 cm BT	30-40 cm BT tags	30-40 cm MW	40-50 cm RB	40-50 cm RB tags	40-50 cm GR	40-50 cm GR tags	40-50 cm BT	40-50 cm BT tags	40-50 cm MW	50-60 cm BT	50-60 cm BT tags	60-70 cm BT	60-70 cm BT tags	total RB	total GR	total BT	total RB,GR & BT	total MW	total SU	total NSC
RS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RMS	0	0	0	98	1	0	1	0	8	0	3	1g	1	0	0	8	1g	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	8	3	23	98	0	1
RM	0	0	0	242	0	2	0	0	16	0	1	0	2	0	0	7	0	8	1g	1	0	0	5	0	0	0	1	0	0	0	0	0	0	0	23	11	4	38	242	0	0
LM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LMS	0	6	0	280	13	3	0	0	14	2g	2	1g	5	0	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	11	7	48	280	25	0
LS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	6	0	600	14	5	1	0	38	2	6	2	8	0	0	18	1	13	1	4	0	0	5	0	0	0	1	0	0	0	0	0	0	0	70	30	14	114	600	25	1

Note whitefish (MW) numbers are totals...no size breakdown was undertaken

Swim #2

Lane	0-10 cm RB	0-10 cm GR	0-10 cm BT	0-10 cm MW	10-20 cm RB	10-20 cm GR	10-20 cm BT	10-20 cm MW	20-30 cm RB	20-30 cm RB tags	20-30 cm GR	20-30 cm GR tags	20-30 cm BT	20-30 cm BT tags	20-30 cm MW	30-40 cm RB	30-40 cm RB tags	30-40 cm GR	30-40 cm GR tags	30-40 cm BT	30-40 cm BT tags	30-40 cm MW	40-50 cm RB	40-50 cm RB tags	40-50 cm GR	40-50 cm GR tags	40-50 cm BT	40-50 cm BT tags	40-50 cm MW	50-60 cm BT	50-60 cm BT tags	60-70 cm BT	60-70 cm BT tags	total RB	total GR	total BT	total RB,GR & BT	total MW	total SU	total NSC
RS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RMS	0	0	0	195	21	1	0	0	18	2g	6	1g	1	0	0	3	1g	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42	8	1	51	195	1	1
RM	0	0	0	126	2	0	1	0	9	1g	9	2g	3	0	0	4	0	11	0	3	1g	0	1	0	1	0	2	0	0	0	0	0	0	0	15	21	9	45	126	23	0
LM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LMS	0	0	0	116	0	0	0	0	30	0	0	3	3	0	0	11	0	5	1g	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41	8	4	53	116	10	0
LS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	437	23	1	1	0	58	3	15	3	7	0	0	18	1	17	1	4	1	0	1	0	1	0	2	0	0	0	0	0	0	0	98	34	14	146	437	34	1

Note whitefish (MW) numbers are totals...no size breakdown was undertaken

SUMMARY

Expansion factor = 1.33 = Total channel width/channel width covered

Expanded Results	0-10 cm RB	0-10 cm GR	0-10 cm BT	0-10 cm MW	10-30 cm RB	10-30 cm GR	10-30 cm BT	10-30 cm MW	20-30 cm RS	20-30 cm GR	20-30 cm BT	20-30 cm MW	30-40 cm RB	30-40 cm GR	30-40 cm BT	30-40 cm MW	40-50 cm RB	40-50 cm GR	40-50 cm BT	40-50 cm MW	50-60 cm BT	50-70 cm BT	total RB	total GR	total BT	total RB,GR & BT	total MW	total SU	total NSC
Total for swim 1	0	8	0	800	19	7	1	0	51	8	11	0	24	17	5	0	0	0	1	0	0	0	93	40	18	153	800.0	33	1.3
Total for swim 2	0	0	0	583	31	1	1	0	78	20	9	0	24	23	5	0	1	1	3	0	0	0	131	45	19	195	582.7	48	5.3
Mean, swim 1&2	0.0	4.0	0.0	691.2	24.7	4.0	1.3	0.0	52.7	14.0	10.0	0	24.0	20.0	5.3	0.0	0.7	0.7	2.0	0.0	0	0.0	112	43	18	173	691.3	41	3.3
Standard Error	0.0	4.0	0.0	108.7	6.0	2.7	0.0	0.0	12.0	6.0	0.7	0.0	0.0	2.7	0.0	0.0	0.7	0.67	0.7	0.0	0	0.0	18.7	2.7	0.0		108.7	7.3	2.0
Mean/Un	0.0	0.8	0.0	144.0	5.1	0.8	0.3	0.0	13.1	2.8	2.1	0.0	5.0	4.2	1.1	0.0	0.1	0.1	0.4	0.0	0	0.0	23.3	8.9	3.8	36.1	144.0	8.5	0.7
Standard Error	0.00	0.83	0.00	22.64	1.25	0.56	0.00	0.00	2.50	1.25	0.14	0.00	0.00	0.56	0.00	0.00	0.14	0.14	0.14	0.00	0	0.00	3.89	0.56	0.00		22.6	1.53	0.4
Mean/ha	0.00	0.3	0.0	51.4	1.8	0.3	0.1	0.0	4.7	1.0	0.7	0.0	1.8	1.5	0.4	0.0	0.05	0.0	0.1	0.0	0	0.00	8.3	3.2	1.4	12.9	51.4	3.0	0.2
Standard Error	0.00	0.30	0.00	8.09	0.45	0.20	0.00	0.00	0.89	0.45	0.05	0.00	0.00	0.20	0.00	0.00	0.05	0.05	0.05	0.00	0	0.00	1.39	0.20	0.00		8.1	0.55	0.1

Equal or > 20 cm	total RB	total GR	total BT	total RB,GR & BT total
	74.7	26.3	17.2	117.2
	100.0	44.0	17.3	161.3
	87.3	34.7	17.3	129.3
	12.7	9.3	0.0	
	18.2	7.2	2.8	29.0
	2.6	1.9	0.0	
	6.5	2.6	1.3	10.4
	0.9	0.7	0.0	

total count for each swim was obtained by expanding the mid lane count (sum RMS, RM, LM, and LMS) x exp. factor), and adding the shore lane (RS, LS) counts

sucker and squawfish counts are restricted to individuals equal and more than 20 cm in length

- a table is included (lower right side) with total rainbow trout, Arctic grayling and bull trout equal and more than 20 cm in order to compare the swim counts with mark-recapture estimates

RS - Right shore | RMS - Right mid-channel | LMS - Left near shore | RB - rainbow trout | BT - bull trout | SU - sucker species
RMS - Right near shore | LM - Left mid-channel | LS - Left shore | GR - Arctic grayling | MW - mountain whitefish | NSC - squawfish

Table River Lower Site
Mark Recapture Estimates
N = (M +1)(C + 1)/(R+1)
N = population estimate
M = number of fish tagged
C = number of fish observed
R = number of tagged fish observed

Swim #1	
Arctic grayling	132
rainbow trout	416
bull trout	42

Swim #2	
Arctic grayling	180
rainbow trout	444
bull trout	21

20 green tagged GR - 4% (hooking mortality) = 19 (rounded from 19.2)
22 green tagged RB - 4% (hooking mortality) = 21 (rounded from 21.12)
2 green tagged BT - 4% (hooking mortality) = 2 (rounded from 1.92)

Table B6. Table River mark-recapture results, and correction factors for underwater fish census.

Section (swim #1 & #2)	Fish species	Total tagged M	Total observed C	Tags observed R	Total fish N	Mean N (2 swims #1 & #2)	Std. Error	Min. number M/N (%)	Significance test (MC > 4N) MC	4N	(a) m/r # fish/ha	(b) u/w swim # fish/ha	Correction factor (a)/(b)
upper #1	BT	10	21	0	242	225.5	16.5	4.1	210	968	46.0	4.0	11.5
upper #2		10	18	0	209			4.8	180	836			
lower #1		2	13	0	42	31.5	10.5	4.8	26	168	2.4	1.3	1.8
lower #2		2	13	1	21			9.5	26	84			
upper #1	GR	81	107	50	174	167.5	6.2	**46.6**	**8667**	**695**	34.2	22.7	**1.5**
upper #2		81	115	58	161			**50.2**	**9315**	**645**			
lower #1		19	19	3	100	118.0	18.0	19.0	361	400	8.8	2.6	3.4
lower #2		19	33	4	136			14.0	**627**	**544**			
upper #1	RB	10	8	0	99	137.5	38.5	10.1	80	396	28.1	2.3	12.2
upper #2		10	15	0	176			5.7	150	704			
lower #1		21	56	3	314	324.0	10.5	6.7	1176	1254	24.2	6.5	3.7
lower #2		21	75	4	334			6.3	**1575**	**1338**			

- Total tagged includes a 4% reduction attributed to hooking and tagging mortality rate.
- Total fish N = (M + 1)(C + 1)/ (R +1).
- M/N = % of total population that was tagged. The minimum number to tag is 20% where the population (N) is less than 1000 (Vincent, 1971).
- For a mark/recapture to provide an unbiased estimate, MC should be > 4N, or M + C equal or > N (Robson and Regier, 1964).
- Enlarged numbers in bold are significant based on M/N > 20% and MC > 4N and are statistically correct.
- Only fish minimum 20 cm were tagged, all data including total observed, refer to fish equal to and greater than 20 cm long.
- (a) m/r calculation is where m = Mean N, and r = hectares of the section - where area of upper section = 4.9 ha., area of lower section = 13.4 ha.
- (b) u/w swim calculation refers to expanded underwater census (Table 7 in Results section).
- BT = bull trout, GR = Arctic grayling, and RB = rainbow trout.